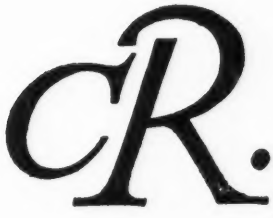
THE CENTENNIAL REVIEW

of Arts & Science



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The Symposium on "The New View of Man"—of which the papers by Professors Margenau, Stakman, Parsons, and Bush are part—was presented at Michigan State University in May of 1955.

PREFACE TO VOLUME I, NUMBER 1

IT IS PERHAPS appropriate for a new magazine to make its first appearance with a few words of introduction declaring its character and intention.

The Centennial Review of Arts & Science derives its name as well as its tone and purpose from its point of origin. The *"Centennial"* commemorates the fact that the magazine was founded, if not first published, in the centennial year of its sponsor, Michigan State University. The first issue contains four papers delivered in a centennial symposium arranged by the University's College of Science and Arts, which publishes the magazine. By custom, centennials are occasions for serious review of academic and intellectual achievements. This magazine, being inaugurated with a "New View of Man," proposes to continue the survey, as a sort of perennial centennial symposium of the arts and science.

So much for the first part of the name. The *"Review of Arts & Science"* denotes the broad scope of the magazine's purpose. It is published by a college of liberal arts and is intended to be a spokesman for the business of such an institution. Hence its manner is forthrightly academic and scholarly. Hence also its aim is to represent the principal disciplines of the natural and physical sciences, the social sciences, the humanities and the arts.

The Centennial Review addresses itself to readers with broad interests in the liberal arts, those who have some curiosity about what is going on in fields of learning not ordinarily within their purview. Avoiding the extremes of specialization and popularization, the magazine is designed to present articles in the several disciplines of the liberal arts in such a manner that the achievements and implications of

specialized scholarship may be disseminated to readers in a wide range of fields.

To this purpose, the magazine will offer papers of several kinds:

1. Reviews of the state of knowledge, and reports on new and important developments of general interest, in the chief areas of the various disciplines.

2. The more or less formal description, characterization, or exemplification of particular scholarly methods, research techniques, or intellectual attitudes; tactics and strategy; the interplay of fact and theory, etc.

3. Interrelationships between established or chronically exclusive disciplines.

4. Historical or critical perspective on current problems, ideas, "knowledge," or belief.

5. Review articles, *not* book reviews but occasional essays which in considering several significant books in a field (or related fields) contribute to broader awareness of the subject.

6. What (for want of a better term and for the sake of an editorial catchall) we will designate "Interesting Things"—i.e., essays which may treat quite limited subjects but which have general interest by reason of style or for mere intellectual curiosity; the byways and backstairs of learning; the devious roads to discovery; adventures in scholarship; etc.

The editors welcome contributions from all fields of the liberal arts; the norm for length is 5000-6000 words. In addition they will welcome letters of comment and criticism, which if they are of sufficient interest may bring into being a letters-to-the-editor department.

The Centennial Review, though not without purpose, has no axe to grind and will not require or maintain any special point of view. And it is open to contributors anywhere. Since this is a general quarterly, a "common reader" and not a specialized journal, contributors perhaps should be reminded —and readers may be assured—that material for it will be

presented in a fairly straightforward manner. It will eschew pedantic footnotes, excessively complicated or esoteric charts and diagrams, and the exclusive jargon, symbolic language, learned assumptions, and other impedimenta of specialized studies. It is hardly expected that our authors can write effectively without using the essential vocabulary of their subject-matter, even though they may at times have to face the difficult task of explaining it. But the cult of incommunicability may be overdone. The general nature of this magazine does impose limitations upon what may profitably be discussed here. Nevertheless it is our premise that specialists in the separate disciplines can convey at least the major results and implications of their work—and probably a good deal more than this—in language understandable to their colleagues in the liberal arts. There are, within the criteria set forth, many topics in all the fields which are susceptible to exposition in *The Centennial Review* and may be expected in its pages. Such discussion should be mutually profitable: it is no more necessary or desirable for specialists always to mumble like medicine men than it is for them to limit their horizons like ostriches.

In entering upon publication, *The Centennial Review* addresses itself to several objectives which at the present time seem to be particularly desirable: a kind of inventory (or at least a fair sampling) of current knowledge in the basic arts and sciences; a description of the frontiers and the shifting internal alignments of the intellectual domain; and a demonstration of the methods, techniques, and attitudes of scholarly inquiry and speculation. In a sense, we are attempting to provide a showcase for exhibiting—both to the academic community itself and to others—the variety and scope of the achievement of contemporary scholarship in the broad area of the liberal arts. The effect of such an ambitious—perhaps pretentious—design might be in a little measure to diminish the fractionalizing of knowledge and the attendant division

and estrangement of scholars; to educate within the academic walls, to reaffirm what might be called the comity of scholars and even perhaps to broaden somewhat their base of operations; and, by tracing the bold outlines of the conceptual framework of our times, to remind academics and others of the mingled and interdependent character of a genuine liberality of awareness.

It is, we trust, with reasonable modesty that we dedicate our publication to these objectives, and declare common cause with other parallel designs. With this issue we are pleased to think that we have started well, and we have more good papers in store for forthcoming quarterly issues.

B.P.M.

Man is not merely made for science, but science is made for man. It expresses his deepest intellectual needs, as well as his careful observations. It is an effort to bring internal meanings into harmony with external verifications.—JOSIAH ROYCE, Introduction to Poincaré's *Foundations of Science.*

THE NEW VIEW OF MAN IN HIS PHYSICAL ENVIRONMENT

Henry Margenau

I. Ways of Studying Man

WHEN DEALING with a subject as large, engaging, and obscure as man, an author is obliged to say forthwith how he intends to approach his problem. For there are many roads leading to partial knowledge of the nature of man; their courses need to be sketched and their goals must be correlated.

A person who wants an estimate of the condition of an automobile before buying it ordinarily does two things. One, he examines its appearance, its parts, and inspects its mechanism; two, he gives it a road test. Man, too, can be studied in these two ways: first by painstaking inspection of his external and internal make-up and then by watching him in action. Anatomy and psychology perform the task of inspection; they are in a limited sense the "sciences of man" and provide the kind of specific, relevant, but partial knowledge which the mechanic gains when he opens the hood. This approach to the nature of man is not the one I am able or expected to conduct.

It is a road test that will be made in this study. The ride could go through many different countrysides, exposing many of the extensive achievements of man, from art and religion down to technology. However, not knowing my way

in most of these areas, I am forced to take you through the field of physical science, endeavoring to appraise *its* bearing on the nature of man. True, this road will lead only to partial knowledge; still it seems proper to couple this protestation of modesty with what may seem an unwarranted challenge; I affirm that the results of modern physical science are of extraordinary importance to an understanding of the nature of man; and furthermore, that this peculiar relevance, hitherto largely ignored, is greatly in need of exposition and emphasis today.

Science as a human activity bespeaks the capabilities of man; as an accomplishment it reveals the nature of its agent. But far more important than this causative relation is the reaction of scientific achievement on man himself, is the manner in which accepted scientific doctrines fashion and modify the cultural essence of man. For man is primarily what he conceives himself to be, and this conception, this self-appraisal is formed vis-a-vis and in relation to the changing picture of the universe around him and to the philosophy which that picture suggests (*1*).

To trace in some detail the reaction of science upon man himself I shall consider briefly some of the effects of every major scientific discovery. The obvious effect is technological, it is the visible and impressive movement from discovery through commercial development, production of new goods and devices, advertising, and sale, toward the establishment of greater comforts of life. This causal chain, which in the end enhances or at any rate modifies our so-called standard of living, our external circumstances, will here for brevity be called the "obvious" movement.

But every truly great scientific discovery launches also another trend, much less apparent and more subtle in its progression from phase to phase through human culture. The discovery, acting as a *fact* in initiating the obvious movement, becomes the lever of an *idea* in the other. It clamors to

be understood, and the scientist must provide some sort of theory in terms of which the discovery takes on significance and organizing power. The theory contains novel features, features contradicting what was previously regarded as true; and by virtue of this apostasy the discovery induces a rearrangement of thought in adjacent fields. Sooner or later the internal structural consistency of the science that was disturbed by discovery is restored, but in the process some cherished beliefs, some aspects of common sense have had to be surrendered. Thus relativity theory has repudiated the notion of universal simultaneity and, to some extent, the simple intuitions of geometry; quantum mechanics denies the continuity of motion; and a good deal of time will probably elapse before men cease to feel that such theoretical consequences of discovery violate common sense.

Results as challenging as these cannot fail to have a profound effect on philosophic speculations. Indeed philosophy, in time, must and does take account of the ideological consequences of scientific knowledge, first by changing its cosmological beliefs and perhaps its theory of knowledge. Changes in one branch will entail changes elsewhere, and even though the sequence of alterations is uncontrolled and haphazard (chiefly because we are less conscious of them than we are of the technological sequence), they nevertheless tend to embrace the entire structure of philosophic thought before their course is run. Thus this movement ends in new views on the nature of the universe, the relation of man to the universe, and the relation of man to man. Ethics, sociology, politics are ultimately subject to infestation by the germ that is born when a discovery in pure science is made. This movement, which terminates in a change of the cultural milieu of man, will be called the "obscure" movement. There is a paradox in the fact that Marxism professes the supremacy of the obvious movement while disparaging the other, whereas the Western democracies reverse the declaration, pay

lip service to ideas, but practice what Marxism professes.

It is most reasonable to postulate, and I believe history shows, that human society enjoys maximum stability when the two movements are in balance. This was often true, both in Western and in Eastern cultures, during the ten or twenty centuries that preceded ours. And the balance resulted from the lumbering slowness of both movements. Gun powder was discovered in the 12th century, used in warfare two hundred years later. Galileo and Newton found the laws of mechanics in the 17th century, the machine age arose in the 18th and 19th. Oersted discovered the magnetic field of electric currents in 1820, electric motors became industrially important nearly one hundred years later. Thus the technological gestation period, the time required for the obvious movement to be completed, was of the order of a century, and there is clear evidence already in the examples cited that it is progressively decreasing.

Considering now the obscure movement, one finds no signs of speed-up. Kant, the philosopher who more than any other developed the philosophic framework for Newtonian physics, published approximately one hundred years after Newton. Modern empiricism, which is clearly a philosophic version of the great discoveries in thermodynamics and statistical mechanics of a century ago, has reached its zenith in our time. And the scientific revolutions that occurred in the atomic field at the beginning of the century, the unprecedented, galvanizing pronouncements of the quantum theory, have not found satisfactory philosophic consolidation to this very day—but look at the swiftness of technology; the discovery of fission resulted in the development of the most perilous of weapons in less than ten years.

Not only in the West, but everywhere do we see evidence of such unbalance between the two movements that started from scientific discovery. The obvious one has been vastly accelerated in all parts of the globe, the obscure has not found

its goal. It flounders and gropes without rational guidance on both sides of the iron curtain, and the ideological cleavage between East and West is, in part at least, symptomatic of the failure of the hidden movement to have completed its run. For it stands to reason that a common science will engender a measure of agreement in philosophic outlook across all artificial curtains when equilibrium between the two movements is finally established, when our intellectual atmosphere is congenial with our applied science.

Hence arises the suggestion, vague perhaps and insecure at this point, that two problems should be of very serious concern to the thoughtful student: how to speed up the obscure cultural movement so as to bring it into step with the other, how to make the obvious movement less obvious, the obscure one more evident. Both ends can be achieved by a shift in emphasis from technical science to the philosophical problems surrounding and pervading science, by consciously taking stock of the need for philosophic digestion of discovery and of our patent failure to achieve it. Fortunately, this need is being recognized by universities and research foundations, though not very clearly as yet by government agencies and industry. But it is not the primary purpose of this paper to note these generalities and to urge appropriate consideration; in what follows, I desire chiefly to show how in fact the obscure movement has proceeded in the past and, if possible, to project a few of the features of the coming philosophy which is in harmony with present physical science. And through all this, I shall outline the views of man and of human destiny implied by outmoded and finally by modern physics.

II. Old Views of Man

1. *Mechanistic materialism.* The vastness of such a task forces one to make selections, and there is no guarantee that these will be regarded by everyone as appropriate. The claim I make is that the three old doctrines here presented for con-

sideration—materialism, logical empiricism, and existentialism—are indeed responses to specific groups of scientific discoveries succeeding each other in time, that they do spell out different, incompatible concepts of man, and that—because of the slowness of the obscure movement—they continue to dominate the modern cultural scene. Even in the limited context of these selections there will be no room for scholarly thoroughness, careful historical analysis, or complete documentation. Nor will the presentation be entirely objective, for it is inevitable that an author's convictions and his dedication to the theme he expresses should incline him to exaggeration. I include this caveat even though I resolve to be fair in my appaisals.

Materialism is a doctrine of many forms, the most plausible and influential of which is what will here be termed *mechanistic materialism*. It is completely characterized by its affirmation of two theses: a) Matter obeys the laws of classical mechanics; b) To be, is to be material, i.e., nothing exists that is not material. The former commits materialism to the hypothesis of universal continuity. All changes occurring in matter must be continuous changes; objects change their sizes and shapes by infinitesmal gradations; they move along continuous paths in three-dimensional space. This character of motion may be said to mean that the position x of any object is a continuous function of the time, $x=f(t)$. To this point we shall return later. If it is felt that the continuity hypothesis is self-evident and logically necessary, let it be recalled that St. Thomas contradicts this allegation by insisting that continuity, far from being necessary, may or may not apply to the motion of his angels. "Motus angeli," he says, "potest esse continuus et discontinuus sicut vult . . . Et sic angelus in uno instante potest esse in uno loco, et in alio instante in alio loco, nullo tempore intermedio existente."

Thesis a), though sometimes questioned in the remoter past (cf. for instance Zeno's paradoxes), became part and parcel

of physical science through the successes of Galileo and Newton. Forces are continuous functions of space and time; they are proportional to accelerations, and by these premises there is defined a differential equation with solutions corresponding to continuous trajectories in space and time. Were it not for the success of this analysis it might be questionable whether science would have embraced the continuity of motion so completely; for experience, even when very refined, does not always endorse it. But scientific success and plausibility established the continuity thesis and made it an integral part of the world view which followed Newton's science.

Thesis b), the identification of existence with materiality, is likewise implied in Newton's work. It became a philosophic conviction at a later time, perhaps as the result of two further developments which enhanced its power and its certainty. Early in the 19th century there arose a sweeping scientific conviction: beginning as a tentative belief in the impossibility of perpetual motion, it developed into the principle of conservation of energy, the certainty that energy can change its form but is basically indestructible. Yet this knowledge was nothing more than an inductive generalization of a multitude of facts, for no one had derived the conservation law from first principles concerning the nature of the universe.

Helmholtz succeeded in doing this. In 1847 he published a famous paper wherein he showed energy conservation to be a consequence of two simple assumptions. One was that nature consists of mass points, i.e., small particles of matter; the other that the force between every pair of mass points is a central force, that is, a force acting along the line joining the two particles. This proof was a tremendous scientific achievement, acclaimed everywhere, and it induced many scientists, because of its dazzling brilliance, to believe the premises of Helmholtz's syllogism along with its conclusion. If conservation can be logically established on the basis of these two

simple postulates, they *must* be true. Every logician knows full well, of course, that this reasoning involves the fallacy of "affirming the consequent," that the same conclusion may be deducible from different hypotheses—but few people bothered about the logic of the situation and few withstood the conviction that nature did, in fact, consist of nothing but mass particles known as matter.

A decade after Helmholtz this view was reinforced by a doctrine of quite a different sort. Darwin published his *Origin of Species,* a work which, on the face of it, seems unrelated to Helmholtz's contribution. But again its world-shaking significance led to an acceptance not only of its essential intent but also of the frills and flavors that accompanied its presentation. The emphasis on the survival of the fittest, the tooth-and-claw behavior of all creatures, seemed to harmonize in philosophic pattern with the physical materialism of the time. And toward the end of the century, fed by other tributaries much like these two, there rose the powerful stream of mechanistic materialism. Man believed that there was indeed nothing in the world that was not material, nothing that failed to obey the laws of mechanics.

2. *Empiricism, logical positivism.* The strict, precise, and unconditional character of the laws of Newtonian dynamics or celestial mechanics with its suggestion that "reason applies to nature," the consequent rationalism of Kant and others, lost support in some quarters when physics turned its attention to the subjects of heat and thermodynamics. Here was a field in which dynamic regularity was not the norm; its laws resulted, strictly speaking, as rare anomalies from the chaotic interplay of large numbers of molecules. The chief era of these discoveries began in the late 18th and extended through the first half of the 19th century, and the names associated with them are Lavoisier, Black, Count Rumford, Davy, Mayer, Joule, Carnot, and Clausius.

Thermodynamics is the most empirical of the physical sciences. Its theorems are relations between an excessive number of experimental variables; it thrives in a situation spurned by other branches of physics, namely, one in which more variables are used than are actually needed. Because its measured quantities are not logically independent, thermodynamic formulas exhibit that well known disfigurement by subscripts added to partial derivatives, an outward indication of its earthy stature, of its factbound significance. There are no neat and elegant second-order differential equations with solutions representing the unique history of a thermodynamic system; the connection between formula and measurement is always emphasized. Nor are the basic laws very simple. The most embracing "law" (in the sense of mechanics, i.e., an equation connecting variables of state) is the equation of state; it is different for every substance and has extremely complicated forms for all real bodies. The contrast with Newton's law of universal gravitation is remarkable and is philosophically suggestive.

Furthermore, even the greatest generalizations encountered in this branch of science, the so-called laws of thermodynamics (which everywhere else would be named principles), entered the scene as inductive inferences from a large mass of experiments and not as deductive consequences of some simple and pervasive conjecture. Much ingenuity has been lavished on the question whether they are as true as the laws of mechanics, or whether they permit exceptions, and even now textbooks sometimes say that water can freeze on the stove if you wait long enough.

The reason for this wary and circumspect approach to the validity of thermodynamics lies partly in its history and its formal structure, but primarily in the reformulation which its discoveries induced within the science of mechanics itself. For in the process of readjustment enforced by the discrepant new knowledge regarding heat, as described earlier, the ideas

of mechanics were enlarged to include the subject of statistical mechanics. This contains all the theorems of Newtonian mechanics plus special postulates concerning the *probabilities* of molecular motions. Only with the use of probabilities can theory account for observed thermodynamic behavior. And the need for probabilities, a novel feature in the explanatory scheme of physics, puts the imprint of looseness and ambiguity, which only actual observation can resolve, upon the theories of heat.

The philosophic implication of all this is perfectly clear. Even if theory says water will boil, one must not trust that prediction without qualification. For experience *may* show that it will freeze. It is all a matter of probabilities. Laws are approximate, and the childish amazement expressed by those who hold that "reason applies to nature" marvels at a fairy tale. Nature fundamentally defies reason; she goes her own erratic way, producing regularity through the law of large numbers, by sheer exhaustion of alternatives for aberration. Law, strictly, is an illusion. And in the midst of this universal play of chance, man is a creature endeavoring successfully to make the best of things, betting on the basis of probabilities.

The preceding account is not an accurate description of the present views of men (Carnap, Feigl, Frank, and others) who call themselves positivists or empiricists. What I intended to sketch is empiricism as it first arose, and as it ought to be if it had remained unmingled with other considerations. Its emergence was inevitable, for it is the terminus of that obscure movement which started from the science of heat and thermodynamics.

3. *Existentialism.* There are scholars who deny the claim of existentialism to be a philosophy; few indeed will recognize it as a world view developed in response to science. It is in the first place a working attitude of artists, a pervasive mood

which passionately seeks to justify the sordid as well as the magnificent contingencies of existence; it includes Nietzsche's joy over the death of God, and Tillich's quietly pious "courage to be." With Kierkegaard it is the resolution, brought on by irritation at the static concepts of traditional philosophy, to progress from the habit of understanding backward to one of living forward. In Malraux the accent is on the absurdity of life and on the need to endow it with significance through adventure; the heroic gambler is the object of justifiable admiration. The works of Sartre, a "widower of God" according to his own testimony, express and portray the nausea of existence (2). But all these men, whether they admit it or not, stage a revolt against science. Their attitude is a response to science, albeit a negative one; their philosophy is, so to speak, a result of the obscure movement jumping its track.

Before I attempt to demonstrate this seemingly unsympathetic assertion, I should say in all fairness that it is an overstatement and not wholly true. For there is an element in the attitude of existentialism that reflects a deep insight of very recent science; I refer to the fact that theoretical physics, by its appeal to probability reasoning, has relinquished its hold upon individual events, on single observations. In a sense these are left untreated by most recent doctrine, and so a special appeal for attention to what is existentially given and scientifically fatherless is just. It may be held, however, that this is an *ex-post-facto* conjecture, an artificial regularization of a movement which has fundamentally broken its bond with science.

For existentialism, when it speaks philosophically, declares war upon "essences," saying that existence comes before essence. What it means is that the unregulated contingencies, the bare and given facts and immediacies of our experience, take precedence over the regularities and constancies constructed or found by reason. The essences of existentialism,

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when freed of poetic disdain, are the constant entities and the laws of science. These are the citadel against which the onslaught of that movement is directed.

The rebellion broke forth openly and under philosophic generalship in the writings of Heidegger. He admits that science is a noteworthy attack upon truth or *Sein* or Being, but one not likely to achieve final and full success. For Being is, in his representation, an existential something that lives in the solitude of human experience and will not be caught alive in scientific traps. It is like rare game which man can espy, stalk, and observe quietly, but which will flee the noisy scene of science, and when the scientist does finally overpower and capture it, he comes to hold the corpse of truth and not living truth. Such a view, when stated more adroitly and without the use of metaphor, tends to assume a measure of persuasive plausibility sufficient to make it the stock in trade of many humanists and artists; it is the central creed of the hard-dying attitude which insists on a basic cleavage between science and the humanities.

The rebellion against science which has taken the name existentialism is aided and abetted by two significant facts. First, modern science has become increasingly and at times forbiddingly abstract, and the artist is repelled by it because in plain truth he cannot understand it. Hence, in curious reversal of that medieval attitude which led the scholar to scorn the craftsman because he spoke too vulgarly and in his native vernacular, the existentialist now spurns the scientist because he uses an esoteric tongue called mathematics which, in the eyes of some, poisons Being before it is apprehended. The second fact giving strength to existentialism is the chaos of modern history which belies reason, order, and essence. Quiet desperation, probing the depths of human tragedy, contemplating death and coming up with the resolve to *be,* to *be* in the face of absurdity—those are understandable atti-

tudes in the modern world of politics, natural to those who have severed their relation to science and to the order which science reveals.

Existentialism concerns itself with the nature of man more directly than any other modern philosophy. Through its commitment to the priority of fact, the doctrine is forced to portray man fundamentally as a creature cast out into a universe devoid of reason. Man engulfed by the abyss of being, finding himself alone, capable of anxiety and sure of death, such is the primary frame of human existence. Relief is sought in diverse ways, by redemption in Kierkegaard and Marcel, by "gambling one's life on a stake higher than oneself" or by "transforming as wide an experience as possible into consciousness" in Malraux. Some, especially the novelists, seek to ameliorate man's prime state of irrational abjection by ethical and political manifestations; they activate, to quote Henri Peyre's excellent summary, "the desire not to remain unmoved by the anguish of other men suffering from the threat of war, by social inequality, or by economic injustice. Several of them have taken sides, usually with the extreme left, in political issues: but they have raised such issues to the height of metaphysical speculation and envisaged evil as a cosmic phenomenon, though one which lies within the power of man to redress in part."

Freedom is a fact and a cornerstone of existential experience; being isolated, unconditioned, and blind, it is at once a burden and a source of anguish. Still it compensates in a significant way for the forlornness of human existence and gives an active concern for the future to a creature whose past is meaningless. Man must make the best of freedom, his singular and most cherished gift. But one gets the impression from reading the literature that its use, its unstinted and enthusiastic use, is also its complete justification. One finds neither a deep concern for the restraint of freedom nor a

search for an explanation of this unusual phenomenon in a world that largely lacks it. Existentialism takes freedom as a fact, not as a paradox.

III. The New View of Man

1. *The decay of materialism and the rise of nonmechanistic science.* In our century science has grown in new directions and has changed to a position that denies the claims of mechanistic materialism and of the extreme forms of logical positivism. And by opening up promising vistas to the gaze of man, it has made existentialism pointless. To the physicist these developments are well known, though even he rarely sees them in their rich philosophic context; I am unable to sketch them here in a manner carrying persuasion for those unacquainted with modern physics, and refer therefore to some of the numerous expositions in the literature. In summary, the salient facts are these.

We have learned to prove the law of conservation of energy, and most other laws, on the basis of axioms far more general than Helmholtz's simple premises, and the historical occasion for our belief in these materialistic premises is gone. The knowing reader will recall the proofs of conservation for an electromagnetic field which is based on Maxwell's equation, and the theories involving the matter-energy tensor.

Matter itself was supposed to exist in two forms, continuous and discrete. The quintessence of continuous matter was the luminiferous ether; the atom, first thought of as a small pellet of stuff, symbolized the other. Let me review briefly the unhappy fate of the ether which has been so vividly described by Whittaker (*3*) in one of the classics of modern science.

The ether was supposedly the tenuous material medium filling space and carrying the light waves as air and water carry sound. Men searched for it through various of its manifestations. If it were material, it ought to have a density, but it was too light to be detected. If it conveyed a wave, it ought

to be an elastic medium—indeed from the high value of the speed of light one might calculate that its rigidity should be enormous—but no evidence of such phantastic properties was found. The ether presented a further anomaly inasmuch as the waves it carried were transverse and not longitudinal. To account for this it had to be equipped with molecules of most remarkable structure, molecules specially designed for the purpose and not encountered anywhere else. In the latter quarter of the 19th century, the great era of materialism—or as I should preferably put it, the era of Rube Goldberg devices—this challenge was met with equanimity and poise, and a successful model was proposed. In Whittaker's words, here is the model of an ether molecule.

> Suppose . . . that a structure is formed of spheres, each sphere being in the centre of the tetrahedron formed by its four nearest neighbours. Let each sphere be joined to these four neighbours by rigid bars, which have spherical caps at their ends so as to slide freely on the spheres. Such a structure would, for small deformations, behave like an incompressible perfect fluid. Now attach to each bar a pair of gyroscopically-mounted flywheels, rotating with equal and opposite angular velocities, and having their axes in the line of the bar: a bar thus equipped will require a couple to hold it at rest in any position inclined to its original position, and the structure as a whole will possess that kind of quasi-elasticity which was first imagined by MacCullagh. (*3*)

Materialism succeeds, but at a price that strains imaginative resources and makes us wonder as to its adequacy.

During the same period attention also turned to the state of motion of the ether. Was it entrained by moving celestial objects, so that each of them carried with it its own private atmosphere of ether? Or was it stagnant, allowing all bodies to move through it freely? Astronomers denied the first alternative; the physicists Michelson and Morley made the second untenable by performing in 1887 their ingenious experiment. The ether became a mere word, the noun for the

verb "to wiggle"; it was the grin of Alice's cat after the cat had vanished. Then Einstein taught us, through his special theory of relativity, that even the word is unnecessary, and modern physics is very comfortable, indeed far better off, without a material ether. Theory has become simple again after MacCullagh's nightmare, and the idea of continuous matter has passed beyond the scientific horizon.

Discrete matter, the atom, has of course remained with us. But it is no longer that pellet of stuff, hard and impenetrable; it has transformed itself into something highly abstract and difficult to picture, into a set of mathematical singularities moving in a space pervaded by electric and magnetic fields. The stuff has been pretty much knocked out of it, and the atom has become a rather empty structure.

The thesis of mechanism has had similar reverses. The motions of atomic particles cannot be pictured with that intuitable directness which the idea of continuity conveys. Elements of the Thomistic angels have crept into the situation. An electron in its motion about a nucleus no longer has a well-defined path, it has "probabilities of being observed." And it is these probabilities, not its actual positions, that are being calculated and predicted by physical theory. Mechanistic description, as we have seen, presented the position x as a function of the time, $x = x(t)$; quantum theory, though still called quantum mechanics, only involves the probability $P(x)$. It confers importance, not on a single observation (such as noting that the electron is at x) but on an aggregate of observations (how many times out of a thousand was the electron found at x?) endowed with probabilities. Through these changes the physicist has above all learned two lessons: a) Reliance on mechanical models suggested by common sense is sometimes dangerous and misleading; b) *Formal* principles of mathematics and of logic must often replace pictorial intuition.

It might seem as if the very tide which swept away the

foundations of mechanistic materialism carried in the substance on which logical positivism is built. This, however, is true only in a very limited sense. For with the new emphasis on probabilities, which is so easily but wrongly interpreted as a loosening up of nature's laws, there came increasing *formalization* of thought rather than a surrender of the precision of science. Quantum mechanics is not like thermodynamics; its probabilities are not the result of human defects, not the kind of lesser evil that makes us try for profit by betting—they are facts of nature cast in a new role, inexorable in their own new meaning. The mere suggestion that we can never know exactly, that empirical knowledge is necessarily fragmentary, is quite abortive, for quantum theory still has that assertive splendor which tends to impose reason upon nature, and it lacks the disposition of *nil admirari* which is typical of the true empiricist.

2. *The coming philosophy.* That hidden movement launched by the discoveries I have outlined is, unfortunately, still somewhere in its middle course, for it has lacked the drive and the resources which propel the other movement at its unprecedented rate. One cannot emphasize this point too strongly before teachers and scholars, whose responsibility it is to integrate our learning and to restore the sanity of our culture: It is not enough for us to fear or to admire science, the greatest challenge of our day is to *humanize* science, that is, to speed the evolution that will set it into an organic relation with philosophy, with culture and with life. Until this is achieved a sketch like the present remains a fallible prophecy. Nevertheless it seems that some features of the coming philosophy can be discerned today without great risk of error, and these I will now undertake to sketch.

a) We are witnessing at present and shall continue to see an enormous widening of the horizon of knowledge and of scientific tolerance. That man will learn more facts is trite

and hardly worth recording. But there are two ways of expanding knowledge; one is the accretion of data in the manner of the physicist at the end of the last century, of the busybody who understood his subject and looked for the next decimal place in the numerical constants of nature. The other is the openminded reception of novel truths with full cognizance of their heresy to past convictions. It is the latter disposition that characterizes the progress of recent science. The smug and complacent attitude of the 19th-century physicist who, to choose a trivial example, denied the existence of a human soul because he could not weigh it or locate its whereabouts, is gone forever. The modern scientist may still deny the soul, but on better grounds. Whitehead's impressive reference to the fallacy of simple location, the reminder that existence need not be tied to location, was startling in its day but is almost a commonplace to modern physics. The rise of interest in objective and dispassionate investigations of phenomena once called occult is in harmony with the new spirit of the time.

There is another way to put the story: science has lost its dogmatism. Present developments show it to be an ever-unfolding human enterprise, a self-corrective dynamism continually engaged in modifying and improving its theoretical structure, a Heraclitic flow of facts and ideas. Science disavows static and final truths, giving in every age a different answer to man's eternal questions, approaching certainty as an ideal limit. It knows that its principles as well as its facts are changing, and it has renounced the error of believing in the possibility of explaining all human experiences, past and future, in terms of those principles and laws which are *now* called science. Such tolerance, and such modesty, will surely be traits of the coming philosophy and the rising man.

b) Rarely in the past has physical science addressed itself to philosophy's agonizing question: What is reality? But it

does so now. And the answer, still tentative and timidly proposed, may well be its greatest and profoundest benediction. For it integrates traditional views and allows them, purged and widened, to exist in harmony.

The theory of knowledge and of man has from the very beginning suffered from a dualism which philosophers have not been able to eradicate. It appeared in the antithesis between Thales and Heraclitus, Anselm and Roscellinus, Kant and Berkeley, and, to name a current manifestation, between Einstein and Bohr (*4*). When stripped of all external complexity the problem is simple indeed. All these men are asking what is real. One group answers: we take the real to be the invariant, rational aspect of experience. The other says, in the words of Berkeley, "esse est percipi." One group singles out as credible, interesting, and valid the elements of knowledge that are permanent, lawful, and therefore rational; the other seizes upon immediate experiences, perceptions, actions, scientific observations, in short the "positive" phases of knowledge. Hence the present conflict between rationalism and positivism.

Many have said that this conflict is an idle and a verbal one, that the choice of position is a private matter of taste. This was true until the advent of quantum mechanics, for the so-called crisis in physics is nothing but the termination of an unphilosophic period in science, a roll call on the meaning of reality. The theoretical physicist has always been at heart a rationalist, for his laws, his constructs, his equations deal clearly and exclusively with permanent and lawful gleanings from a larger experience, while the experimenter often, though not always, was a positivist because he endowed direct observation, manipulatory operations, and the like with special and ultimate significance. But in classical physics this did not matter, because theory predicted in every detail what was observed; every P-plane fact had a unique construct as its

counterpart,[1] and in the presence of this universal correlation a choice between rationalism and positivism was unimportant. The positivist had the P-plane and could infer from it the theoretical notions if he so desired; he made a defensible point when he argued that theories were *renderings* of facts made in answer to our desire for economy of thought. The rationalist had his constructs, his essences, his universals and could in principle deduce the concrete world; he lost nothing except the respect of his adversaries when he slighted sensory experience and dubbed it a mere manifestation of rational essences. Each picture was complete, each mirrored the other, and it was hard to tell which was the original and which the reflection. The mirror, in a sense, was man, and his function was trivial.

Now, as we have seen, the immediate facts of experience are no longer predictable in detail from theory, reason has lost its absolute hold on fact, essences no longer bind existences completely. It is as though in a fundamental way rationalism had been split apart from positivism. To use a phrase of Bohr's, they have become complementary to each other. This complementarity, however, is not an idle reduplication of one realm by another, as some still hold; on the contrary, it forces upon us the need for recognizing a distinction between (at least) two kinds of reals: that which enters into our reasoning about nature, the rational entities, and the laws of physics—atoms, electrons, fields, and probabilities; and that which assails us coercively through our senses or results from our active participation in the world. I can do no better than to call them *physical* and *historical* reality. They are no longer completely isomorphic, even though they are coincident in a very large domain of experience. They do break apart, indeed they are most widely separated in those individual human acts that have historic significance, acts

[1] Roughly speaking (in the terminology of reference 5), the "P-plane" is the locus of all immediate (perceptory or "protocol") experiences, while "constructs" denote the rational, conceptual experiences.

which by their uniqueness and their singleness are not parts of a collective whole to which the probabilities of the quantum theory must be referred.

Historical reality, thus conceived, is not far from the existentialist's world. And modern science documents to some extent the validity of his views. But it shows them to be part of a more embracive picture, for the world of physical reality is still there, its laws regulate events in the aggregate even if they have lost the stringency to govern every detail. This conclusion is reached by an analysis of modern science, and it seems to restore to life that richness which rationalism and existentialism individually tend to destroy.

c) As we have seen, the mechanistic philosophy of the 19th century presented human freedom either as a paradox or an illusion. Kant, who preceded this movement and who found a more idealistic interpretation of Newton's mechanics, suggested a more delicate treatment of the problem of freedom but had to leave it in the limbo of his antinomies. Quantum theory throws an entirely new light on freedom.

It says that the law of cause and effect still holds with respect to the constructs and essences that constitute physical reality, to which since Kant it had always been applied. The basic differential equations describing the changes of physical systems are as precise as ever, and the entities they govern—atoms, nuclei, and electrons—continue to have properties like charge and mass which are measurable with indefinite precision. In this realm causality prevails.

But among the qualities governed by those causal laws are now to be found probabilities, and these in a sense make the causal scheme rather academic. For they refer to what is observed or, more generally, what is directly experienced. Probabilities of events can be predicted with accuracy while individual events elude all forecasts. The situation in atomic physics is much the same as in the actuarial field, where the number of deaths in a large group can be predicted despite

complete ignorance as to who will die. There is lawfulness in the realm of essences, but much chance in the field of observable facts. Let us see what this means with respect to freedom.

No one knows how to apply quantum theory to a human being or, for that matter, to a complex molecule. Hence we have to pitch our arguments on a simpler plane. Assume an electron to be moving toward a target, for example a television screen, and suppose all knowledge concerning its state of motion to be available. This knowledge must and does conform to strict laws of nature, to the essences of the rationalist. Despite this, however, it does not specify the point of impact; it predicts only the mean position at which a million electrons, when similarly projected, will hit the screen. Exactly where this one will fall, all available knowledge, all imaginable experimentation cannot make sure. Causal analysis leaves lacunae of uncertainty in the behavior of this particular electron, and it does not say how they are filled. Furthermore, it is the well-considered belief of most physicists that physical theory, by its very nature, will not fill them.

Now the presence of these lacunae in physical causation does not spell freedom. If this concept could be applied to an electron, mere uncertainty as to the spot it is going to hit does not make it free; rather, it makes it unpredictable or randomly behaved. If the same kind of uncertainty were present in man, his actions would be erratic, and one simply could not tell whether he was free, i.e., capable of responsible decisions, in the sense of the moralist.

If, on the other hand, principles not known to present science but quite different from the laws of physics—and I should say principles of a *psycho*physical nature, principles that involve the presence of consciousness and that are as inapplicable to unreflective matter as the laws of thermodynamics are to single particles—if such principles could be

shown to fill the lacunae of physical causation, something like freedom might result. To refer back to our hypothetical example: If the electron itself decided where, within the penumbra of physical determination, it would impinge on the screen, then it could truly be said to be free.

It is clear that physics is a long way from explaining that human freedom which declares its presence so forcefully in our introspective consciousness. But it does make room for it, it takes freedom from the wastebasket of paradoxes, illusions, and irrelevancies, and lifts it to the shelf of challenging problems to be solved. The scientist is no longer a fool when he talks about freedom, and man is no longer restrained from professing it. Even the form of a possible solution of the problem is visible in outline. Attaining it will probably involve two steps. First, it must be shown that the uncertainty surrounding the physical behavior of small atomic entities persists uncancelled through the composition of atoms into organisms. There is already some evidence for this. Secondly, it must be made clear how, in the process of material organization, a self-reflective and self-determinative principle becomes active. And there is some precedence for this in the Pauli exclusion principle, as I have indicated elsewhere (5).

d) Man's new understanding of nature has resulted in a dispersal of scientific dogmatism, in a sense for the distinction between physical and historical or existential reality as well as in their conciliation; it has removed the paradox of human freedom. Finally, almost as the fulfillment of a promise vaguely implied by this series of advances, modern science releases man from his restrictive role as a spectator in a universe that is quite complete and objective without him. He has become an active participant in the drama of existence; no longer a passive watcher of a stage preset, he has come to know that the stage is different for his presence.

I do not mean this in the trivial sense that human beings change the nature of the physical world through their actions.

There is nothing new in that, and it is as proper now as heretofore to contemplate this fact for moral comfort. Yet, it was always agreed that man can change the world through action. But what about knowledge, what about the search for truth? Put in a simple way, the new fact is that search for truth modifies truth, that there is an effect of the knower on the known, that *knowledge, too, is action.* Four decades ago the typical observation of science was the measurement of the position of a star, an act wholly detached from the celestial object far away and insignificant to its further motion. The astronomer took pride in being able to make such measurements without disturbing the star, and envious physicists considered this kind of non-disturbing measurement as their ideal. Today, with our principal concern about the atom, we regard such observations as atypical, as limiting cases never realized, and we consider as normal the measurement of the position of an electron, wherein the fact that an observation has been made is crucial to the fate of the electron. Even the process of acquiring knowledge, we now learn, has the determinative quality of action upon a previously stolid but now pliable universe.

When the genius of Heisenberg first confronted the physicist with this interpretation of the measuring process, he evinced a shocked reaction, for his whole concept of objectivity was shaken and his neat distinction between the spectator and the spectacle broke down. Had he been less provincial (I crave your indulgence for this truism voiced so long after the fact) he would have noted that his was the only science, indeed the only branch of learning which thus far ignored the interaction between knowledge and the known; the new discovery made physics more like biology, social science, history, and economics, where the occurrence of what is now called "feedback" between the subjective measurement-knowledge-prediction process and the external system subjected to the process, was already a commonplace. The

biologist knew that certain of his observations inevitably kill an organism; the physicist was alarmed to realize he could not measure a photon's position without destroying the photon. The alarm has subsided, biology and physics face similar problems, and another of the passive features of the old mechanical universe had disappeared.

Beside the uncertainty principle, to which the last remarks have been confined, there are other indications leading to the conclusion that the curtain between the knower and the known is disappearing, and suggesting a necessary involvement of man in nature not only through action but through knowledge as well. There remains no abode for detached contemplation which makes no difference to the world. Man, freed of earlier prejudices, with a humbler approach to ultimates and absolutes even in science, with a new appreciation of the existential qualities of experience and a glimmer of freedom that is neither paradox nor illusion, has finally seen his *facts* turn into *acts*. It would seem that the evolving philosophy commensurate with such fragments of present vision must portray man in a measure of wholeness and dignity he did not hitherto possess.

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1. This point has been made with greatest cogency by F. S. C. Northrop in his well known books *The Meeting of East and West* (New York: Macmillan, 1946) and *The Taming of the Nations* (New York: Macmillan, 1953).
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THE NEW VIEW OF MAN IN HIS BIOLOGICAL ENVIRONMENT

E. C. Stakman

THE IMPLICATION of the assigned title is that there is something new to look at in man or his biological environment, or both, or that there is a new way of looking at the same old man in the same old environment. Is there really a new view or merely a new viewer?

In reality there always is a new man and a new environment. At least there always are new men—85,000 of them each day, according to yesterday's newspapers—and the hope is that they are continually improving intellectually and ethically. Certainly the environment is continually changing, sometimes for better, sometimes for worse, both because of man's efforts and despite his efforts. There is a continuous succession of new men in a continually changing environment.

What is man's biological environment? Naturally it includes all living plants and animals, wild and domestic, macroscopic and microscopic, good and bad. And it must include man, wild and domestic, good and bad. It can be interpreted as including also the media on which plants and animals feed and grow, together with the factors affecting their growth. It includes, therefore, soil and water as media for plant growth, and the plants, animals, and man which are media for the growth of parasites and food for predators. It could include climate also, as a factor influencing the living elements in the environment.

Is this environment man's in the sense imputed by the possessive pronoun his? The degree to which it is his depends

on man's desire and ability to alter and control it for his use; it depends on his ability to obtain food from it, to maintain health, and to get along with other men. It becomes, then, a problem of human subsistence, human health, and human relations.

That the environment changes and that man helps change it is, of course, obvious. The real question is regarding the degree of man's mastery and the wisdom with which he exercises it. The statements of a philosopher, a geographer, and a historian are pertinent.

William James, the philosopher, says, "Man is an organism asserting itself in its environment, experiencing, acting now with success, now with failure, but always interested and adventurous. The mind is an advance agent that reaches out and tests the environment for the organism."

According to Gordon East, in his *Historical Geography of Europe,* "The European peninsula, as the home of man, presented at all times a changing panorama, the elements of which were both natural and man made, and the human geography of present-day Europe is the product of some thousands of years during which men have occupied and modified this environment."

H. G. Wells, the historian, states, "By fire and plough and ax man alters his world. By destroying forests and by irrigation man has already affected the climate of great regions of the world's surface. . . In the future, by making such operations world-wide and systematic, man may be able to control climate to an extent at which as yet we can only guess."

James bluntly calls man an organism, which of course he is, even though there may sometimes be reluctance to admit the fact. He is an amazing organism from a biological viewpoint; sometimes it seems that he is so amazed with himself that he is likely to lose perspective with respect to himself in relation to his environment. If man asserts himself in his environment, as James says, he modifies it to suit his purposes

insofar as he can. The mind, then, is not merely an advance agent that tests the environment; it devises ways of changing it. There are far-reaching implications to the statement that man is always "interested and adventurous." Progress has been made largely by those minds that were extraordinarily interested and adventurous, by minds that dared to be unorthodox. Have all societies really learned this lesson?

East's statement is quite explicit and suggests the evolutionary nature of man's modification of the environment. The emphasis on the factor of time is important and is too little appreciated by some zealous and impatient men who have the naive conceit that the world can be remade quickly and easily in any desired image.

The suggestion of Wells that man may be able to control climate "to an extent at which as yet we can only guess," by operating systematically and on a world-wide scale, may seem visionary. As the actual and potential biological environment is determined so largely by temperature and rainfall, anything that can be done to control them or to adapt plants, animals, and man to extremes and fluctuations would help solve one of the major problems that has confronted man for thousands of years.

How much can man modify his environment? Future prospects can be based partly on past experience. The basic intellectual capacity of man seems to have increased and the application of intelligence to solving problems of the environment certainly has increased. But it has been a long, irregular, slow, evolutionary process, with the barriers to progress not only outside but also inside the minds of men.

Man was a long time in evolving from an organism that adapted himself to his environment into one that adapted the environment to himself. It is one of the tragic limitations of man that he can not experience the remote past and the remote future at the same time. He must depend on records for the one and on his imagination for the other. And the

records of the remote past are dim and fragmentary. One of man's greatest accomplishments was the evolution of methods for recording, preserving, and transmitting knowledge by means of language and history. And yet we tend to neglect both at a time when they are so urgently needed for intercommunication and for perspective.

Man's prehistory probably lasted about half a million years. Even primitive men of the old stone age made crude weapons and tools from stones, but there is no evidence that they modified the environment appreciably. Indeed, the Neanderthal man, who may have persisted for about two hundred thousand years, may have been too unintelligent to survive in competition with the more intelligent men of the Neolithic or polished stone age who supplanted him in Europe some twenty-five or forty thousand years ago.

Some Neolithic men, as exemplified by the Cro-Magnon group, who have left eloquent testimony of artistic ability in caves in southern France and Spain, possibly were comparable with modern man in intellectual capacity, but knowledge and inventiveness had not yet enabled them to change their environment by domesticating plants and animals. They were essentially food gatherers; they stalked and hunted the mammoth, the bearded pony, reindeer, bison, and auroch or great ox that survived in the forests of Germany until Roman times and then disappeared from the environment entirely.

A new man apparently came to Europe some ten or twelve thousand years ago. Although still a hunter of the royal stag, the auroch, the bison, and other animals, he was also a cultivator of plants, not merely a food gatherer. He thus not only took advantage of his environment but began to change it. The Swiss Lake dwellers and similar peoples, about seven thousand years ago, cultivated wheat, barley, millet, peas, and flax. They had domesticated the dog, cattle, and goats. They had a material civilization; they were new men, and they created a new environment by putting and keeping many

plants and animals where they wanted them. Agriculture had begun.

With the migration of peoples to new areas, known plants and animals were disseminated more widely and new ones were domesticated. The discovery of the use of metals and the desire for beautiful and useful substances that were available in some places but not in others led to industry and commerce, which in turn enabled man to utilize a more extensive environment and to change his environment by substituting more desirable for less desirable plants and animals. Astronomy and mathematics were applied in changing the environment by establishing a chronology of seasons, by predicting and utilizing seasonal flood waters, and by constructing irrigation and drainage systems in ancient Babylonia and Egypt.

Most of the great civilizations of the past were based primarily on agriculture, on man's knowledge and control of his biological environment. Indeed, according to M. D. C. Crawford, "Civilization is, as it were, a second flowering of barley, wheat, rice, and Indian corn." Industry and commerce were important, but bulk food supplies had to be assured, in those turbulent times, within areas under control of the people who needed them. Thus, grain fields, olive groves, vineyards, and legumes supplanted native vegetation in the Graeco-Roman civilization of the Mediterranean area. Cereal grains and legumes became staple foods. And over the centuries many supplemental foods, vegetables, fruits, spices for flavoring, sugar-producing plants, and better forage plants for animals were discovered, improved, and disseminated. Along with the exchange of useful plants and animals, however, there also was the exchange of weeds, insect pests, plant diseases, and human diseases from one part of the world to another. Man had learned to disseminate useful elements in his biological environment, but he had not yet learned how to prevent the dissemination of the deleterious elements. The age of science had not yet dawned.

The migration of peoples occupies considerable space in most of our histories. The migration of plants and animals is important history also, although it is a curricular orphan even in many agricultural colleges. According to Fabre, "History celebrates the battlefields whereon we met our death, but scorns to speak of the plowed fields whereby we thrive; it knows the names of the king's bastards, but cannot tell us the origin of wheat. That is the way of human folly." Maybe history would be more meaningful if the emphasis were shifted somewhat, but at least we need history. Many plants and animals have been world travelers, and from small beginnings now populate much of the earth's surface. What would the United States be without wheat, oats, barley, rye, rice, sugar cane, sugar beets, alfalfa, sorghums, soybeans, citrus fruits, and horses, cattle, sheep, and swine? They were all brought from other continents, from the Eastern Hemisphere. All of our principal crop plants except corn, potatoes, and tobacco, and all of our farm animals except the turkey were imported. The Western Hemisphere reciprocated somewhat by furnishing corn, tomatoes, potatoes, cacao, Hevea rubber, tobacco, and other useful and noxious plants to the Old World. It is fortunate for us, as well as for others, that embargoes on plants, animals, facts, and ideas were rare.

Not only did man take many kinds of plants and animals to new and sometimes better homes, but he managed to find new kinds of plants that were better suited to their old homes. He improved his plants and animals. From the diversity of wild types he selected and propagated those that seemed best; he aided nature in her process of natural selection and the survival of the fittest. More than two thousand years ago the Greeks recorded the relative virtues of different varieties of certain crop plants. They knew a great deal about their plants and animals, but they did not understand them. Even Theophrastus, the "Father of Botany," and Aristotle, the great natural philosopher, did not understand the elementary

physiology and reproduction of plants. Nor did any one else begin to understand them for almost 2000 years after the passing of the glory that was Greece and the grandeur that was Rome.

It is amazing that man made as much progress as he did while he understood as little as he did. But progress was slow; it had to be, because man knew only what happened, not why it happened. "Scientific agriculture" among the Greeks and Romans was a curious mixture of sense and nonsense. In many respects they had good practical knowledge about plant and animal production; they were at least somewhat naturalistic. But when they ran out of practical knowledge, they attributed success or failure to the position of the moon and the stars or to the moods of one or more of their many gods. And so they developed codes and rituals and invented new gods to help them out of their difficulties. The Romans besought Ceres, Flora, Robigus, and other gods and goddesses to help them in their farming operations. "Stern Robigus spare the herbage of the cereals; withhold we pray thy roughening hand" is the opening of a Roman prayer to their grain-rust god, who lasted almost a thousand years. To learn all the prayers, incantations, rituals, and ceremonial procedures that a Roman farmer was supposed to know would require a five-credit, two-semester course for the average graduate student in agriculture today, especially if he had not yet passed his language examinations. And this is not said in disparagement of Greeks, Romans, graduate students, or language examinations.

The Greeks in the Age of Pericles and in that of Alexander the Great tried to understand their biological environment, but they did not understand its real nature. They observed, they sometimes speculated shrewdly, they experimented somewhat; but they did not invent appreciable aids to the senses. They had no microscopes, no thermometers, no spectroscopes. They had only brains. Had they been more inven-

tive, they might have become as great in science as in philosophy. Had they had the political wisdom to unite permanently their city states instead of warring themselves to death, their civilization might have lasted longer. We can learn much from Greece.

And we can learn much from the blackout of scientific attitudes during much of the Middle Ages. There was more retrogression than progression. Intellectual authoritarianism was so strong that it was taught as late as the fifteenth century that the legs of the fox were shorter on one side than on the other; that the elephant had no joints in his legs and could not lie down; that bees carried gravel as ballast when in flight; that the lion drew a circle around himself with his tail when he lay down to sleep, that no animal dared enter the circle, but that the lion slept with his eyes open. Could it be that the lion doubted what the professors taught and kept his eyes open to see if it were true? There are reasons why there might have been reluctance to examine bees for their gravel ballast, but foxes were killed for sport, and the professors could have measured the legs with safety and profit. We smile indulgently at these teachings of the funny professors of the past. But there was nothing funny about the consequences of the almost complete suppression of a naturalistic and rational attitude toward life and living; the funny teachings of the teachers were only one symptom of an orthodoxy, traditionalism, and authoritarianism that not only blighted the intellect but also the lives of human beings. Filth and squalor were considered inevitable. The result was epidemics of diseases such as the black death that decimated populations and filled life with horror and dread; and the only remedy was to burn nonconformists by the thousands. It was not the suppression of what science there was, it was the inhuman result of the suppression that was so tragic. Bigotry is no less dangerous today than it was five hundred years ago. The new view of man in his biological environment is or should be the view of a man to

whom truth about the facts of his environment is sacred. He can only learn the truth about this environment by studying it thoroughly and honestly, and the truth should be sanctified by its human values.

More than ten thousand years from the new man who learned to change his biological environment to the new man who began to understand it! Ten thousand years of progress based on empiricism; a hundred years of progress based on science!

The flowering of biological science was approximately contemporaneous with the founding of Michigan State University. Whether the relationship was causal or only chronological, the fact is that the long search for scientific understanding began to bear fruit about the time Michigan State was founded.

Darwin and Wallace established the principles of organic evolution, which some philosophers, poets, and scientists had sensed dimly and expressed vaguely from the days of Aristotle onward. Aristotle to Darwin—more than two thousand years during which some men had been searching for truth regarding natural relationships among plants and animals and the mode of origin of new kinds. Handicapped by the dogma of special creation and fixity of species, and often by rigid authoritarianism, basic concepts developed slowly and often were expressed cautiously. But finally Darwin's *Origin of Species* appeared in 1859. Darwin not only stated that evolution was fact but explained how it came about through variation, natural selection in the struggle for existence, and the survival of the fit. This revolutionized ideas regarding the plants and animals in man's biological environment.

Mendel's experiments on the mode of inheritance in hybrid peas laid the foundation for the science of genetics, which is basic to the art of plant and animal breeding. First published in 1865, the results did not become generally known until

1900, almost half a century after Michigan State University was founded.

The basis for soil science, plant nutrition, and physiology was just being laid about the time this university was founded. Liebig, the father of agricultural chemistry, thought plants got their nitrogen from ammonia in the air; Gilbert and Lawes at Rothamstead were showing that they got it from the soil. Not until 1886 did Hellriegel explain the nature of the root-nodule bacteria in legumes.

After a hundred years or longer of controversy regarding spontaneous generation of bacteria, Pasteur finally furnished generally acceptable evidence that they, like other living organisms, arose from other individuals of their own kind. The compound microscope had been invented in 1590, but it was almost a century later before bacteria were discovered and described, and more than two and a half centuries later before it was learned how they grew and what they could do. The microscope was needed to reveal the invisible world of microorganisms, but the genius of Pasteur was needed to show that they could cause wine to sour and could cause diseases of silk worms, sheep, and human beings.

Devaine, Koch, and others deserve credit along with Pasteur for establishing "the germ theory of disease." In any case, Michigan State University witnessed the discoveries that microscopic organisms and viruses could cause diseases of plants, animals, and man; it witnessed the development of rational methods for controlling them.

Progress has been amazing. Man is beginning to understand and control his biological environment, macroscopic and microscopic, to an extent almost undreamed of a hundred years ago. He has learned to improve plants and animals; he has learned how to make them more productive; he has learned much about protecting them and himself against the ravages of microscopic and ultra microscopic killers. Knowl-

edge has expanded vastly. Man has become scientific; he should be wise.

Man has also been astonishingly inventive. He has emancipated himself extensively from the limitations of his senses and muscular powers. Scientific apparatus and power machines enable him to know and do things that he never could have done without them. For centuries he had harnessed the ox, the ass, and the horse; he learned to harness wind and water, then steam, gas, oil, and even atomic energy. Man has acquired control of power. He has become technologic; is he wise?

Mankind is again at the crossroads, looking for the right road. Ours is said to be the first generation that is seriously concerned about the welfare of its grandchildren. Although this may not be true literally, there is evidence of confusion in the present and concern for the future. This may indicate that man realizes that he needs more knowledge, foresight, and wisdom. Man has encountered many crossroads during the course of his evolution toward civilization. Sometimes he has chosen well, sometimes badly. Races of man have become extinct, civilizations have decayed and collapsed. But civilization as such has survived many crises. The trend has been generally upward, with many temporary fluctuations, and some racial and national casualties along the way. The course of civilization apparently is not predetermined, automatic, and guaranteed to reach Utopia. It depends on man's own efforts, on man's intelligence, his will, his ethics, his wisdom. He has needed them in the past; he needs them now. Possibly he needs them more urgently now than ever before. Whether the present crisis is more dangerous than those of the past may be debatable; but there can scarcely be any debate about the fact that there is a present crisis.

Man is menacing himself with two tremendous powers: the power of atomic energy and the power of human reproduction.

Man's intellect has given him partial control of tremendous energy that can be used with terribly destructive effect or with humanly beneficient effect. Man's will must determine what he wills to do with this energy. And he should will to act as wisely as possible.

The power of human reproduction also is tremendous. The population of the world is exploding in our faces. It is now about 2.5 billion and is increasing at a rate of 1 per cent or more a year: at least 25 million new mouths to feed each year.[1] At this rate there is another Australia to feed every 4 months and another Canada every 7 months, another United States every 6 years. In forty years, at the present rate of increase, the world will have to feed at least 3.5 billion people, possibly more. The rate of increase is greatest in the newer countries of the Western Hemisphere, but the absolute increase is greatest in the densely populated countries of Asia. Despite a high death rate, the population of India and Pakistan increased by 48 million in the decade 1931-1941. Despite the death of 100 million from starvation in China during the past century, estimates are that the population will reach 950 million by the year 2000, only forty-five years in the future. Is there enough land and water in the world to feed and clothe the products of man's prolificacy?

Unfortunately land, unlike population, is not expansible. Most of the best land is already in use, and some is deteriorating. It takes about two and a half acres to subsist one individual decently, with present methods of cultivation. There are about 33 billion acres fit for human habitation. But only about 3 billion is actually cropped. There can be added the equivalent of another billion of the 5 billion of permanent meadow or pasture. This makes the equivalent of 4 billion acres of crop land, or 1.6 acres per capita, considerably below the amount required. Almost 9 billion acres are in forests and woodlands, much on lands not suitable for cropping. Food

[1] United Nations experts now estimate 32 million.

supplies grown on land are supplemented somewhat by fish from the waters. But 98 per cent of our food comes from land plants, and the principal source of food energy for 97 per cent of the world's people comes from the cereal grains. World production of these basic foods in 1948 was 28 billion bushels, which would yield 1650 calories for each person daily. This is below the danger line of 2000 calories and far below the desired 2600 calories. There is hardly enough food now, but the situation would not be alarming if what there is could be better distributed.

It is evident that we must try to get more land for cultivation or cultivate better what we now have, or invent a way of getting food energy from some other source than plants. Most of the good lands already are in cultivation. There are, however, vast deserts and considerable areas of tropical jungle. Can the deserts be made to bloom, and can the tropics be tamed? Obviously, arid lands can be made productive only if more water can be provided, from the rivers, the sea, the clouds, or from subterranean sources; or if water now available can be used more efficiently; or if plants and animals can be found or developed that require less water. Much of the land in the tropics is not the Eldorado it once was supposed to be. The tropics are now classed, for many reasons, as regions of lasting difficulty. The world's population, then, is increasing faster than available and prospective food supplies. But there are even greater present problems because of maldistribution of land in relation to population. There are food surpluses in some countries and acute shortages in others.

Land is badly distributed in relation to population. Only a few favored countries, such as the United States with more than 3, have as much as the required 2.5 acres per capita. France has about 1.5, Italy less than 1, Western Germany far less than 1, Belgium, China, Java each have only about 0.5, and Japan has only about 0.25 acre. What can these countries do? Those that have colonial possessions, like France and

Belgium, can count on supplements from them. But most of the others have no colonies and are utilizing available land to the limit. They are confronted with several alternatives: lower the level of subsistence; reduce population by reducing the birth rate or by emigration, or by starvation or suicide; industrialize and trade the products for food, if they can—and some cannot; live on the charity of richer countries; increase the efficiency of agricultural production, if they can; or they can swarm like wolves and grasshoppers and kill or be killed in the process.

To state the problem is easy; to solve it is difficult. The statement that "overpopulated countries should not have become overpopulated" may be true, but it is no solution of the problem to say that it never should have come into existence. It is in existence. And semantic subtleties regarding the question as to whether there really is overpopulation are small comfort to those peoples who cannot produce or buy enough food to feed themselves decently. Semantics is a poor substitute for bread. The situation was aggravated by certain territorial and other adjustments after World War II. Regardless of the justice or the wisdom of many post-war settlements, they unsettled many situations, created problems that are insoluble in the near future unless extensive and difficult readjustments can be made; and they created new tensions in a world that is figuratively smaller but actually more crowded than ever before.

The statement that nations must learn to adjust population to resources does not solve the present problem, as many countries already need corrective measures instead of merely preventive ones. Unless they can get more food, they must decrease their population. But how? Infanticide and senecide, not uncommon expedients among some peoples in the past, outrage our modern sensibilities. And we have become too humanitarian to be indifferent to premature death by starvation and disease. We are too nationalistic in many countries

to welcome large numbers of immigrants from many overpopulated countries. Birth control? Entirely apart from questions of scruple or religion, population brakes of this kind operate slowly.

Man is confronted with a serious dilemma. He has learned how to feed more people on less land and how to keep more of them alive longer by controlling diseases. Then he discovers that there are too many people and that too many of them are in the wrong places. He is confronted with an overall shortage of food and has not developed the wit to distribute well what there is. And this comes in an era when an Atlantic Charter can guarantee freedom from want, among other freedoms; when we are promising higher standards of living to countries that cannot possibly feed their present populations decently with their present resources and in the present state of knowledge and skills in respect of food production.

Two-thirds of the people of the world are said to be engaged in producing food, and at least two-thirds of them are hungry. It is platitudinous to say that a hungry world is not likely to be a peaceful world, especially when the discontent of the hungry is aggravated by the smugness of some of the overfed. The United Nations and some of its specialized agencies, such as the Food and Agriculture Organization and The United Nations Educational, Scientific and Cultural Organization, are trying to alleviate the situation, because, sooner or later, directly or indirectly, most nations are likely to be affected by violent discontent in other nations. By making his efforts systematic and world wide, man possibly may change climate somewhat, as Wells suggests, but he certainly can allay some of the unrest caused by hunger.

What are the prospects for the future? There are several possibilities. Man may be able to devise ways of utilizing solar energy for food production more efficiently than plants utilize it. He may invent artificial photosynthesis. He may devise

efficient ways of growing algae, yeasts, and other organisms in tanks. He may get food energy from quite new sources. Until shortly before Michigan State was founded, it was believed that organic compounds could be made only by living organisms. Now the chemist makes hundreds of them in the laboratory. Can he synthesize foods in factories? It is possible.

Man may be able to utilize lands that are now considered unfit for cultivation. He may make the deserts bloom; he may convert tropical jungles into bountiful gardens. It is possible and partly probable.

One thing is certain. Man can make present lands, and waters, more productive. He has done it in the past; he is doing it now; he can do it even better in the future if he enables science and technology to function on a scale commensurate with the magnitude of the problem.

Malthus, about 150 years ago, declared poverty and distress to be unavoidable because population increases in geometrical ratio and means of subsistence in arithmetical ratio. Malthus first recognized only war, famine, and disease as checks on population, but later recognized moral restraint as a factor also. But he did not reckon with the service of modern science, imperfect as it still is.

Since Malthus' day, acre-yields of wheat have doubled in Western Europe; potatoes yield at least two- or threefold; sugar beets have been converted from wild plants into cultivated plants with two times the sugar content of their progenitors; good modern sheep yield two to three times as much wool as the old Highland sheep.

The soil is beginning to be understood. When Michigan State was established it was not even known how plants got their nitrogen. The basic principles of soil fertilization are now understood. The use of radioactive phosphorus is telling soil scientists when and where to apply fertilizers to get maximum value at minimum cost. Within the past few decades it has been found that certain elements, such as zinc, copper,

boron, sulfur, manganese, molybdenum, and others also are essential in minute quantities, a few parts per million sometimes enabling plants to thrive where they are non-productive or abnormal without them. Likewise, boron and certain other necessary elements are deleterious when present in slight excess. Selenium in certain soils of western United States can make plants unfit for human or animal consumption, and its effects must be appropriately counteracted.

The progress made in plant improvement would have seemed impossible a hundred years ago. New kinds of plants have been freely interchanged among peoples and are being grown where they are especially adapted. Sorghums, requiring far less water than corn, made it possible to extend agriculture with reasonable safety into the dry areas of the American Southwest; Crimean wheats made it possible to push wheat-growing westward into the Great Plains; early varieties helped push the wheat belt far northward in Canada; soybeans, one of the relatively recent plant immigrants from Asia, is now one of the principal crops in the corn belt of the United States. The corn belt itself has expanded 500 miles northward within the past fifty years.

Within the lifetime of many of us, agriculture has expanded westward and northward in North America to areas that were considered suitable only for the buffalo and a few cattle or for hardy grasses and scrub pine fifty years ago.

The old longhorn beef cattle required three or four years to make a thousand pounds of beef; modern beef breeds, well fed, can do it in about fifteen months or less; pigs used to take nine months to put on 250 pounds, they can now do it in six months. Some of us remember 1897 when one pig in seven in the United States died of cholera, and farmers were helpless because no one even knew the cause of the disease. Sanitation, vaccination, drugs, antibiotics now are used to maintain health of farm animals as well as of human beings. Animals, like plants, need certain chemicals, including minute quanti-

ties of microelements. New information is continually being obtained and applied.

The progress made by applying science to agriculture is well illustrated by comparison of productivity in World War I and in World War II, because every effort was made to produce as much as possible during the war years. During the years 1942 to 1945, inclusive, American farmers produced about 2 billion bushels more corn than they could have produced on the same amount of land in World War I. In a single year of World War I, one plant disease, stem rust, destroyed about 300 million bushels of wheat in the United States and Canada. Losses in the same area in World War II were negligible because of plant public health measures, such as the eradication of rust-bearing barberry bushes and the development of wheat varieties that resisted the prevailing kinds of stem rust. Varieties of oats yielded from 20 to 50 per cent more in World War II than in World War I. The efficiency of animal production was estimated to be 25 per cent higher than in World War I. The use of improved farm machinery in World War II released enough land previously used to feed work animals to fatten 16 million cattle or 26 million hogs.

It is estimated that in 1900 the production of 100 bushels of wheat required 108 man hours, and this was reduced to about 47 hours by 1940. This is a remarkable record of achievement, but it does not tell of the large amount of basic research, patient experimentation, and invention on which the progress was based.

Man, however, has not yet acquired complete control of his biological environment. He has not yet succeeded in eliminating hazards of bad weather and bad pests. In 1954 the durum wheat crop of the United States was almost totally ruined by stem rust. This could happen to the entire wheat crop in certain years. In large continental areas where much of the bulk food supplies of the world are grown, the hazards

of weather are still tremendous. More than 20 per cent of the seeded acreage of winter wheat in the principal wheat-growing areas west of the Mississippi River was abandoned in the spring of 1955 because of winter injury. During the past thirty years the annual production of wheat in Kansas has varied from more than 200 million bushels to less than 60 million bushels; that in North Dakota from more than 150 million bushels to about 20 million; that in South Dakota from approximately 50 million to less than 5 million. For the country as a whole it has varied from more than a billion to less than half a billion. Corn production has exceeded 3 billion bushels but was reduced by drought in some years to about half that amount.

Plant diseases and insect pests still menace important crops in even so advanced a country as the United States. The terribly destructive rusts of wheat and oats are a good example of plant diseases that can become devastatingly epidemic over large areas with frightening rapidity. Stem rust of wheat is caused by a microscopic parasitic fungus that reproduces by means of spores about one one-thousandth of an inch long. There are about 50,000 billion of these spores on an acre of fairly heavily rusted wheat. They can be blown far and wide by the wind and cause widespread infection far from the place where they were formed. About 275 parasitic races of the wheat stem rust are now known, and nature is continually producing new ones. It is therefore a continual fight between science and nature to determine whether man can produce rust-resistant varieties faster than nature can produce new kinds of rust that can ruin them.

For fifty years attempts have been made in the United States to produce permanently rust-resistant varieties of spring wheat with all other desirable characters, including resistance to many other diseases. It is not easy to combine all the necessary qualities in one variety. Although many satisfactory varieties were produced, all succumbed sooner or later to

new kinds of stem rust or other diseases. Resistant varieties were available, however, about twenty years of the fifty. The longest period was from 1938 to 1949, inclusive. Several good varieties resisted the races of rust that were then prevalent. But they are no longer resistant because a rust race that can attack them heavily flared up in 1950 and was spread by the wind to almost all of North America. New varieties are being developed and distributed. How long will they last?

The many other microorganisms that cause diseases of crop plants, domestic animals, and even man, are insidious and shifty. To devise ways of counteracting the destructive effects of these countless billions of microorganisms requires continuous research. Science is needed to interpret present situations, to forecast what may happen in the future, and to prepare for new emergencies.

And so man has changed his biological environment over much of the earth's surface. He has converted prairies and woodlands and swamps and some deserts into farmlands and has populated them with plants and animals that he considers best for the time being. Man is continually improving these plants and animals; there has been and still is a continual succession of potentially more productive kinds of plants and animals; plant and animal ecology tells him the best kinds for certain areas; soil science and plant and animal physiology tell him how to feed them better; plant and animal pathology and entomology help him protect them against living parasites, predators, and viruses.

Man has also learned to study himself and his relations with other men. The social sciences also contribute to the development of the new man in his new environment.

Despite all of his amazing progress, however, man has not yet learned how adequately to protect many kinds of plants against the tremendously destructive effects of bad weather and bad diseases and bad insect pests. Nor has he learned sufficiently that cooperation instead of contention with other

men could help him master his biological environment. He has not yet attained adequate mastery over plants, animals, and himself. Can he improve?

To improve still more, man needs a series of alliances: between society and science; between different societies; between science, ethics, and the other humanities; between society and all educational agencies.

Society and science need to understand each other better. They render mutual services and have mutual obligations. Science must serve society, but society must understand the magnitude of the problems that it asks science to solve and must support it accordingly. Depth of insight and breadth of vision are needed. Some scientists must be left free to search for new truths and principles, without the obligation to solve immediately pressing problems. There must be basic research; it is likely to be most useful eventually, either in deepening and broadening man's understanding or in furnishing more nearly permanent solutions to problems. There must be individual research by intellectual pioneers. But there must be systematic and coordinated scientific investigations also, such as the wartime atomic energy project, in which specialists contribute their special knowledge and skills to the solution of big problems. And society must furnish necessary facilities. Where are there facilities for studying winter injury to wheat, alfalfa, and many of our other most important plants? Is there in the United States a single field house for such purposes that is comparable with the field houses for sports that are becoming the most conspicuous feature of many university campuses? By all means, let us play; by all means, let us have artificial ice for hockey and artificial heat for basketball. But by all means let us have equivalent facilities, at least in a few places, where weather also can be made to order to help science eliminate some of the greatest obstacles to an assured production of food. Science needs facilities.

Science needs freedom. It cannot thrive in a straitjacket of authoritarian or restrictive attitudes and regulations. This is true both of the natural sciences and of the social sciences, although the latter may have the greater problem. Nor can science thrive best if it is condemned for rendering services that society demanded of it in times of stress. The misdemeanors that some societies commit against science are misdemeanors against itself and those of its members who so urgently need the services of science.

Science owes as much to society as society owes to science. Society supports science directly or indirectly. Few scientists have the financial means to support themselves and to provide the expensive apparatus that is needed in much of modern research. When society contributes funds for research, it clearly has the right to stipulate the purpose for which they are to be used. It is a wise society, however, that supports those scientists whose motivation is curiosity as well as those whose motivation is to solve practical problems. But scientists should reciprocate by contributing to society, each as best he can.

Closer intellectual alliances are needed between different societies, between different nations. Regardless of questions of nationalism or internationalism, cooperation between nations is essential to the solution of many problems. International cooperation in scientific and cultural fields may be desirable for its own sake. However that may be, it is essential in man's struggle to control certain elements in his biological environment. The bacteria, viruses, fungi, and insects that menace man and his plants and animals do not respect international boundaries. The wind carries countless billions of spores of cereal rusts and other plant disease fungi between Mexico, the United States, and Canada. The rust problem is regional, not national. Hordes of grasshoppers and many kinds of other voracious or viruliferous insects spread their wings and sail across natural boundaries without even dip-

ping their wings in salute to their new country. Infectious diseases of man and animals manage to cross boundaries and often develop into pandemics.

The Food and Agriculture Organization, the World Health Organization, and United Nations Educational, Scientific and Cultural Organization, specialized agencies of the United Nations, were formed in recognition of the international nature of many problems. Whatever one may think of the United Nations as a political organization, cooperation on mutually important problems such as food and health is mutually beneficial. We in the United States are still searching the world for badly needed drought-resistant, winter-hardy, and disease-resistant varieties of many crop plants. In all humility we need to remind ourselves occasionally of what we owe to other countries: wheats—Red Calcutta, Black Persian, Crimean, Chinese, Kenya, Jaroslav emmer, Australian Gabo, Turkey Red, and hundreds of others from every continent. And we need more now, urgently, because we have none that resists the red scourge of rust in its present form. Manchuria, Himalaya, Nepal, Abyssinian, Trebi, Montcalm barleys—the names suggest the sources. The U. S. Department of Agriculture is testing in several countries the best of 15,000 kinds of wheat and 6000 varieties of barley from all corners of the earth, in an attempt to find urgently needed characters to breed into our own varieties. We are giving to other countries, but we should not forget that we are continually receiving much also. International cooperation is a practical necessity.

We need a closer alliance between science and ethics. As William James says, in effect, truth is the expedient in our way of thinking; right is the expedient in our way of behaving. Truth and justice are essential in creating a new view of man in his biological environment. Man must improve himself still more if he wants to improve his biological environment still more.

Finally, a grand alliance is needed between society and all educational agencies. Man has gradually evolved toward intellectual enlightenment and spiritual refinement, toward civilization. The further progress of civilization depends on the degree to which individuals evolve toward still greater intellectual enlightenment and spiritual refinement. We need deep and broad scholarship—the habitual application of informed and disciplined minds to the solution of problems. But these minds must be given moral purpose; they must develop ethical concepts; they must learn more about the living world in which we live. They must disprove John Fiske's statements that there has been more progress in intelligence than in kindness, and that half the cruelty in the world is due to the stupid incapacity of man to put himself in the other man's place. Intellectual capacity, intellectual industry, intellectual initiative, intellectual integrity, intellectual imagination, intellectual boldness—all these are needed. But human understanding, an understanding of the problems and viewpoints of other people and peoples, is needed also. Brains are needed, but they need to be in human beings.

"The new view of man in his biological environment" views a wiser and better man in a more beautiful and more bountiful environment. The new view may be only a vision, but it can become reality if education develops brains, if society enables them to function, and if they are guided by the Golden Rule.

MAN IN HIS SOCIAL ENVIRONMENT— AS VIEWED BY MODERN SOCIAL SCIENCE

Talcott Parsons

I

FOR NEARLY a century, since the publication of the *Origin of Species,* the view of man in intellectual circles in the Western World has tended to be dominated by the perspectives of nineteenth-century biological science. The great all-important consideration has been man's continuity, through the processes of evolution, with the rest of the organic world. Stoutly as this trend was long resisted from religious points of view, it is not too much to say that it has on the whole been the intellectually dominant one. At one time it seemed to be challenged by the emphasis on economic factors, a tendency of course far broader than the specific Marxian version. This, however, was an unstable compromise, and a persistent reductionism has tended to operate. What was really meant by the role of economic factors (erroneously, I think) has been, much more often than not, determination by the necessity of securing the means to satisfy needs which were biologically defined, above all the needs for food, shelter, clothing, and sexual gratification. Indeed when Freud's new theories first came to be widely known in intellectual circles in the 1920's, they also were (again at least in part erroneously) overwhelmingly taken to constitute a confirmation of this view; was not the essence of Freud's view that man was driven by his sexual instinct?

The last two generations have seen an impressive develop-

ment of the direct scientific study of human behavior, not merely in terms of general comparison with other organisms, but in the concrete settings of man's social relationships and cultural patterns and beliefs. The central significance of man's biological nature and his evolutionary continuity with the rest of the organic world has by no means been lost. As a result of this study of social behavior, and of the theoretical thinking which at once has guided it and has resulted from it, there has, however, gradually emerged a substantial revision of the perspective in which human nature has been seen. The process of revision has now proceeded far enough so that it will, I think, be fruitful to attempt to pull together some of its principal aspects in a synoptic exposition.

It has of course long been understood that, however important his continuities with the rest of the organic world, man was in many respects unique. One principal aspect of this uniqueness rests on the fact that man is, to an at all comparable degree, the *only* culture-building and culture-bearing animal. Language, though there are important forerunners, is still entirely unique to man, and is found in *all* biologically human groups, as is also symbolic elaboration of belief systems in the field of religion, and a technology which involves at least tool-using. Written language, rationalization of beliefs, technological elaboration, etc., bring the higher civilizations still farther from anything known on subhuman levels.

Social organization is of course widely found in nonhuman species, being highly developed among the social insects. But it is certainly central to all human groups. Furthermore human social organization is unique in that it is most intimately involved and intertwined with man's culture. It is the social unit which develops, transmits, and maintains culture. Some such units, as for instance those of kinship, are at first sight mainly biological in origin and function; but others, particularly in the higher civilizations, like factories, churches,

universities, or parliamentary bodies, are even to common sense perception overwhelmingly involved with culture.

There is a sense, then, in which the distinctively human traits must apparently be understood in terms of a double relationship: first that man is in a particular sense a social animal, but second that *human* society, as distinct from others, is most intimately bound up with cultural conditions, is both a product and a condition of the distinctively cultural aspect of human life and behavior.

Perhaps the major axis of biological theory has concerned the relations between hereditary and environmental factors. In strictly biological theory this has mainly related to two contexts: with respect to the individual organism, the relation between its genetic constitution and the state of the mature organism as defined by the anatomical and physiological properties of the latter; with respect to the species, the relation between its genetic constitution and the selective processes summarized under the principle of natural selection.

The socio-cultural features of the distinctively human problem have, within this framework, directed attention sharply to a special aspect of the heredity-environment relationship, namely, the problem posed in the field of *behavior* as distinguished from questions of anatomical structure or physiological process. The problem may be stated thus: what are the relations between the constitution of the organism and the relevant aspects of the environment in which it is placed? This, of course, is the problem of *learning*, in a psychological sense.

It is clear that there is an inherent connection between environmentalism and learning. In terms of specific content only a very small part of culturally defined behavior could possibly be explained directly in terms of biological heredity. Culture must determine *learned* behavior, dependent on specific relationships between the particular organism and the particular environment in which it has been placed in

the course of its life-history. At the same time, in order to make man's extraordinary capacity for learning understandable, it has been necessary to realize that in constitutional terms he is a very special type of organism. In particular, the genetic basis of specific behavior patterns is necessarily elaborated far less than in other species on comparable levels of biological organization, while at the same time this plasticity, as it has often been called, could not be a simple matter of biological regression, because unusual positive capacities are needed to explain cultural creativeness.

II

The above is a bare sketch of the major frame of reference, in terms of our historic biological preoccupations, in which I wish to attempt to place and draw inferences from certain of the findings of the socio-cultural sciences in the past generation or so. The last theme, namely that of the specific genetic features of man which bear on his capacities to assimilate, maintain, and develop culture, is a fascinating one, but unfortunately not yet in a very satisfactory state. Both for this reason and for lack of space, I must refrain from attempting to follow it further here. It is, however, one of the most important concerns for the relations of biological and social science. In my own opinion it could not satisfactorily develop until social science had reached certain levels. It is to be expected that its most important findings will emerge in the future.

If the central socio-cultural problems center on human learning and its consequences, then a primary focus of the problem concerns the content of what typical civilized human beings learn. Only when we have some idea of *what* must be learned can we meaningfully attempt to assay our knowledge of the processes of *how* it comes to be learned. It therefore seems to me that some generalized knowledge of critical aspects of human society and culture provides the es-

sential setting for a discussion of the problem of learning and its mechanisms.

Modern social science has now, I think, developed to a point where a workable outline of the most critical facts in this area can be presented. I may start with the rather trite formula that the individual must learn to behave in terms of the categories and definitions of the situation of his culture, and that a critical feature of this process, in turn, is his learning to play the roles required by membership in his society and its many subsystems. As a very general statement of what faces the individual, this is correct. Nevertheless the content problem concerns the actual structure of the social and cultural systems which he must learn. Here sociology, anthropology, economics, and political science give us the essential information we need.

Behavior, conceived in an evolutionary sense, is of course a very old phenomenon. It consists in adjustment processes involved in the *relationship* of an organism and its environment, processes which are in certain respects fundamentally different from those internal to the organism which can be mediated by directly contiguous tissues, or those which are involved in physico-chemical interchanges with the environment. The *elements* of the problem of learning and even of culture are given at this internal level, that is, there must be perception and, in some sense, cognition. In short, self-direction of behavior, implying independence of the environmental fluctuations, means goal-directedness, a tendency to attain or maintain what in some sense are optimal states in the relation of organism and environment.

This is to say that far down on subhuman levels the set of behavioral relations between the organism and its environment come to constitute a *system* which must be distinguished from the internal physiological system of the organism and from the biochemical level of interchange. The behavior system is to be regarded as a system of *control* relative

to the physiological system; it determines the location of the organism at different times, the relation to the food supply, the level of exposure to various dangers, and of course the relation to sexual objects essential to sexual reproduction. Again on subhuman levels behavioral interaction with other organisms, particularly though by no means exclusively of the same species, is commonplace.

It is into this context of the behavior of the organism as a system and of the interaction of the behavior systems of different organisms that the problem of the nature of the sociocultural systems with which we are concerned must be fitted. We may presume that originally the behavior system was mainly instrumental to the needs of the organism in a physiological sense. But certainly in the course of evolution its relative importance has grown, and the homeostatic mechanisms of the physiological system have become intertwined with the goal-directed mechanisms of the behavior system. Again, we may presume that instrumental behaviors have contained a larger element of flexibility, in the sense of sensitivity to environmental influences and hence capacity for learning, than have the more fundamental goal-orientations.

If, however, the behavior system is to be considered an independent type of system, then all of its components, not merely some of them, must be conceived as changing through evolution. The crucial point for present purposes is then that the *goals* sought in behavioral systems are not to be assumed to constitute a static function of independently given physiological needs, but as themselves evolving in the course of the extension and elaboration of behavior systems.

It is in this context that the development of human society and culture may be conceived to have constituted a radically important step in the larger process of evolution. Not only has man attained a previously unheard-of level of behavioral control of instrumental processes, particularly as over the physiological needs of the subhuman level, but also his be-

havioral system has evolved to a point of crucial capacity for developing new systems of goals that constitute levels of independence, in respect to the physiological need systems, which are unknown to subhuman species.

Despite all prehuman analogies, the essence of human culture seems to lie in the high levels of symbolic control-patterns which are attained. Sign-behavior is certainly common at many animal levels, but not the linguistic level of symbolic process, i.e., the capacity to use physical stimuli completely unrelated to their meaning in order to signify not merely individual objects but very high-level *categories* of objects, and perhaps even more important, categories of *relationship* between objects which cannot in any physical sense be directly observed at all.

Finally, it should be made clear that there is not a simple dichotomy between "physical" and "cultural" objects in the human situation. Culture itself is highly complex and involves a ramified hierarchy of levels of generalization. What we think of as the progress of human culture or civilization clearly has something to do with the attainment of progressively higher levels of generalization and consequently of organization and control of behavior.

The above considerations apply in principle to behavior in general. Wherein lies the special significance for human culture of the phenomena of *social* interaction? It seems to me to focus at two main points, both concerned with the development of new goals rather than merely new instrumental techniques through learning. "In nature" the organism is exposed to a physical environment which over a very wide range varies and fluctuates without reference to the interests or needs of the behaving organism. In such a situation the tendency is strong to seek "adaptive security" through behavior which fixes on certain minimal necessities of need-gratification, and for the rest tends to minimize risk in the dangerous areas of the situation. If the vicious circle of the primacy of

adaptive security is to be overcome, there must be some way of stabilizing the environment so as to eliminate at least some of the dangerous or valueless fluctuations in it.

Here a special opportunity arises out of the fact that from the point of view of any one behaving organism the behavior of others constitutes a critically important part of the environment. Once a significant innovation has been hit upon, through whatever channels, if it can be taken over by a *plurality* of behaving individuals, it can then serve to define the situation for those of their successors who are subject to their influence. This means that the instabilities and randomness of the environment are cut through, and the individual in question is given an opportunity to learn under greatly more advantageous conditions than would obtain were he isolated from the influence of others. This seems to be a fundamental condition of the possibility that human culture can develop cumulatively; without this in one sense artificial stabilization of the environment, there could be no solid base from which to build a solid structure of elaborated cultural pattern for the individual or the social group. Only when a sufficient number of individuals have such a base, which to a sufficient degree is shared in common, is the foundation for further innovations secured. What I have called the artificial stabilization of the environment is thus both an essential condition of advanced cultural learning for the individual, and a condition of further cultural progress for the society of the group. Social association on intimate levels is inseparable from cultural-level living, and also from the further development of culture.

The first basic reason for the importance of social interaction to cultural development thus concerns the *possibility* of attaining high cultural levels of behavior. The second to which I referred concerns the motivation to this attainment. I have several times emphasized that the greater the relative importance of the behavior system, the more it is necessary

to learn new goals which are to some high degree independent of the genetically given goal system. Motivationally, however, this is a peculiarly difficult form of learning and depends on special conditions. It is clear that the central condition is the establishment of what psychologically is called attachment to or dependency on other human beings who are already committed to the goals in question. When the human individual has once been placed in a position where doing anything but fulfilling the expectations which others have formed of his behavior is an intolerably dangerous thing, and when his attempts to fulfill them are adequately supported and rewarded, he can be brought over the hump which is involved in renouncing his "innate" biological urges in favor of becoming civilized, i.e., a culture-oriented human being. This is the essential strategy of the process of socialization as it occurs in human societies. The child is really left no alternative, he must accept culturally defined goals, which are in some sense at variance with his biological heritage, or perish physically or psychologically. By and large he somehow works out ways and means of making the best of the situation.

Seen in these terms human socio-cultural development is a kind of "operation bootstrap." No human being as an individual has the resources to make more than tiny steps in the process of cultural advance. But mutual support in this advance can multiply the effects of the individual steps manyfold. The individual who takes such a step does not merely get a certain distance in advance of his fellows and thus out on a limb, for if his advance can be communicated to others (through cultural channels) and accepted by others (because they are mutually interdependent), then a platform can be built which is a position which can be held by a group or society. Succeeding individuals in the society can, more or less automatically, be brought up to the level of their predecessors, and this platform can serve as a base from which further advances can be made.

III

The foregoing exposition has been concerned with very simple fundamentals which may seem to have relatively little to do with the functioning of the higher culture-level societies which we know. Though not touching the immense complexities of the higher developments of culture, social structure, and personality, they do, however, give us some bases for understanding two very central phenomena of human behavioral systems, namely the phenomena of institutionalization and internalization, as the current technical terms have it.

Institutionalization is the technical name for the fact that *generalized* patterns of cultural behavior-ordering come to be built into the actual constitution of systems of social interaction (societies and their subsystems), so that the control of behavior in terms of these patterns or rules becomes the primary feature of the organization of the social system itself as a system.

Learned goals originate, it may be held, in some sort of matching between environmental situations and gratification experience. If they are to continue persistently to dominate behavior, however, the relevant elements of pattern must be generalized, eventually at the highest levels, so as to permeate and organize a wider part, even, in a certain sense, the whole of the behavior system. Furthermore they also tend, as just noted, to generalize interpersonally between different socially interacting individuals. When a symbolically organized culture pattern extends beyond the definition of a specifically limited goal-state to permeate and regulate large sectors of a behavior system in other aspects, in instrumental and in expressive activities, then it may usefully be called a pattern of *value*. The institutional structure of a social system then centers on the patterns of value held in common by its members.

By saying that a pattern of value is "held" by the members of a collectivity, I mean that they are in some sense and to some degree motivationally "committed" to its fulfillment across the board in *all* the relevant contexts of its application, not merely with respect to any particular goal-specification. Being committed in this manner means both accepting the obligation of fulfillment and being motivated to carry it out, either in the sense that as a direct goal-state this fulfillment brings direct gratification, or that the personality is so organized that non-fulfillment will entail excessive psychic cost.

Motivational commitment is of many kinds and degrees. To use it as a criterion of institutionalization is in no way to suggest that if value-patterns are alleged to be institutionalized in a society there must be perfect conformity with them in overt action in every respect; this is of course a matter of degree and approximation, with great unevenness. Nevertheless it may be regarded as a cardinal tenet of modern sociology that the institutionalization of value-patterns is the fundamental basis of structure and order in the society. The value-system and its institutionalization constitute the focal points of reference for the analysis both of structure and of process in social systems. I have elsewhere called this the theorem of the "institutional integration of motivation." It may be stated as the proposition that, for a social system to maintain stability a sufficient proportion of its members must be positively motivated to fulfill the institutionalized expectations of their respective roles. It follows of course that if a social system is in fact relatively stable, this statement must be empirically true with respect to it.

What is the implication of this conception of institutionalization of values for the nature of the culture-level human personality? The first point may seem rather trite, but it is exceedingly important, namely that in the empirical sense

there are no such things as societies and personalities as concretely distinct entities. Personality is a concrete set of behaviors so far as it is treated as organized through reference to the same living organism as actor. A social system is a system of behavior constituted by the interaction of a plurality of living organisms. The behavior of interacting actors is thus *always* at the same time part *both* of personalities *and* of social systems. In this sense they are not merely interdependent, they interpenetrate.

In the light of this fundamental fact about the relation of personalities and social systems, what can be meant, in personality terms, by the motivational commitment of an individual to fulfillment of an institutionalized value? If the value-pattern in question is part of the institutional structure of the social system, it must *also* be part of the structure of the personality systems of the members. There is not one set of values held by the members of the society and another set institutionalized in the society. They are the *same* values, and the different systems are the same concrete phenomena, seen from different reference points and analyzed differently.

The fact that value-patterns are not simply external objects in the situation to which persons react, but that they must be treated as constitutive parts of the internal structure of the personality itself, has come to be designated by the technical term "internalization." The understanding of this phenomenon may be regarded as one of the great landmarks of the social sciences of this century. It is notable that this insight was an independent achievement on the part of at least three near contemporaries, who were also in different disciplines, namely Sigmund Freud, George H. Mead, and Émile Durkheim. Indeed this insight may be said to be the cornerstone of the understanding of the relations between human personality and social systems.

IV

Though the time span is almost infinitesimal compared with that of organic evolution, human socio-cultural evolution has been going on for a long time and has traversed many steps as well as taken several paths. This means that in the "higher civilizations" culture and society have reached levels of generalization, differentiation, and organization which are a long way from whatever may have existed in the earliest ages of man. It follows that the system of internalized value-patterns of a civilized man as personality must be of a high order of differentiation and complexity. If this were not true, the theorem of institutional integration could not be true; there is no other basis on which to explain the relative stability, precarious as it may be, of the higher-order societies.

But, if it is true that civilized man has internalized a complex value-system, it seems to me that this fact has a very radical and still unfamiliar implication for the nature of the personality of civilized man. In harmony with the post-Darwinian climate of intellectual opinion to which I referred earlier, the general tendency of psychology has been to look to the constitutionally given need, drive, or instinct system for the *main* set of reference points for understanding the structure of human personality. This way of looking at the problem has automatically tended to throw the cultural elements of personality into the instrumental category as concerning learned *ways* of attaining *given* goals.

A certain challenge to this point of view has been implicit in the "environmentalism" of the behavioristic school of psychology, but it can be said that on the whole the challenge has not been taken up. The place of learned goals, or secondary drives, has of course been clearly conceded, and this is a most important step beyond the older instinct theory. Yet there has been no concerted attempt to study secondary drives as a *system,* nor to show their systematic relations to

the *structure of the situation* in which not single drives, but whole complexes of them, are learned. On the whole the tendency has persisted to consider that the primary drives are primary not merely in the sense of occurring earlier in the developmental history of the individual, but of being the primary bases of organization of the personality.

An alternative view is suggested by the importance of internalized cultural values in personality and also of the ways in which this internalization links with their institutionalization in societies. This veiw is that, whatever the stages of transition may have been, for civilized man the *main* basis of the organization of his personality is to be found in the structure of this internalized value-system, and in the internalized objects which are its bearers. Both values and internalized objects must be considered as organized systems.

This does not mean that man is now any whit the less a biological organism than he and his evolutionary forebears have been. To be sure he is a rather specialized type of organism, but very definitely he is one. It was, however, suggested above that the behavior system has functioned as a system of control relative to the organism. It seems probable that, as the behavior system has reached cultural levels, this control has become enormously extended and refined, and with it the potentialities of the organism for in turn controlling its environment. As cultural development in its social setting has proceeded, the center of gravity of the individual's behavior system, of his personality, has then shifted from being the servant of the biologically constitutional need system, to becoming in certain respects and degrees its master. The realm of culturally defined values embodied in the higher-level social systems has, in this specific and overwhelmingly important sense, taken the place of the biological need system as the specifically human center of personality organization. This, it may perhaps be said, is the greatest human achievement.

This view of the structure of human personality derives in its more direct ways at least as much from sociological as from psychological sources. In the most direct sense Durkheim is its most immediate author. If the role of values in society is what the relevant trend of sociological thought says it must be, and if the broad general relations of personality and social structure are what they seem to be, such a conclusion follows almost directly.

There is, however, extremely important confirmation from certain parts of Freud's analysis of the process of the development of personality in the family, even though on the whole this conception of Freud has often tended to be interpreted in quite a different light. This confirmation centers on Freud's conceptions of the role of object relations in the process of personality development or socialization. It was Freud who first formulated the concept of "identification" to refer to what now may be called the internalization of the mother as an object and correspondingly of her values at a certain level. The process then goes on to the child's later love-attachment to the mother, and then the oedipal crisis in which for the first time the father figures in a critical way.

What is necessary to supplement Freud's theory of object relations is a more systematic account than he gave of the structure of the systems of objects in which the child is involved at the various stages of his development. This is essentially a matter of the sociology of the family, of its socialization function and the relation of mother-child subsystems to the overall family, and finally of the articulation of the family with other structures in the society. This is a fascinating field, but for the present it must suffice to say that the object-relation theory of Freud and the modern sociology of the family can be brought together very readily with a surprisingly close mutual fit.

The resulting conception is that the main line of personality development for civilized man consists in the inter-

nalization of successively more complex *systems* of social objects. These objects consist in the roles taken by the members (including those taken by the child himself) in the systems of social interaction in which the child participates. An increasing complexity of the relevant social systems is concomitant with an increasingly high level of generality of the patterns of social value which are internalized.

V

At the beginning of this exposition I took as my point of departure the view of the nature of man which had developed in the perspective of nineteenth-century biology. I believe that this perspective has on the whole dominated—although it has never stood alone—the thinking of the Western intellectual classes in the period immediately preceding our time. An earlier past was dominated by a view which emphasized the radical gap between man and all other species, a belief based on the special creation of man for religious goals, and this view is very much alive today. And whether or not it relies explicitly on religious arguments, the whole complex of views which sees man as wholly independent of his biological heritage belongs in certain respects in the same category. Man as religiously the child of God, man as thinker, as artist, as guided by moral ideals, all these have seemed to many to be concepts which were utterly irreconcilable with the view of man as a biological organism, as merely the last of a series of evolving species-types extending back into the primeval slime. Must the modern conception of man rest content with this irreconcilable duality between the tough-minded naturalists to whom man is *only* an organism essentially like any other, and the tender-minded idealists by whom he is sometimes conceived to be altogether exempt from the laws of nature?

Perhaps the view of man summarized in the present exposition may prove to be a step in the direction of bridging this

yawning gap in modern thought. The *content* I have referred to in the discussion of value-patterns and their internalization as utilized in the modern social sciences, is all derived from what in a broad sense is the humanistic tradition of the treatment of man in society and culture. Indeed it is scarcely too much to say that the development of these sciences on a substantive level has come overwhelmingly from these sources, and that the early attempts, such as that of Spencer, to extrapolate biological theory directly into the human social realm proved in general disastrously abortive.

Indeed developments from both sides have, as we can now see, moved steadily toward the kind of meeting I have attempted to sketch here. If we take as our keynote for the conception of man in the evolutionary perspective, not only his anatomical and physiological constitution, but also the nature of his *behavior* as a system, we see that what is distinctive to man is the increasing elaboration of this behavioral system and, in the course of this, the development of behavioral control both over the physiological organism and over the physical environment. Man as actor does not supersede, but comes to control man as organism. What is most distinctive to man, seen even in biological perspective, then turns out to be that he creates, bears, and utilizes culture, and that he lives in the kind of social relations with his fellows which makes this possible. His social relations and his culture, then, are not mere epiphenomena to his biological nature, but become, as I have argued, the very core of his distinctively *human* personality and character. The independence or autonomy, relative to the organism, of social and cultural controls, of beliefs and values, is the essence of man's special position in the organic world.

It is not for me, as a social scientist, to presume to assess the philosophical implications of this position. I may merely note that the continuity to which the development both of biological and of social science seems to point is so far-reach-

ing that the older philosophical opposition between materialistic or mechanistic and idealistic philosophies seems to be very much in need of revision. I am aware that much progress in this direction has been made in philosophical work.

One of the most prevalent sources of anxiety for many humanistically inclined intellectuals is that both biological and social science will somehow operate to destroy belief in the individuality and closely linked creativeness of man. What is the bearing of the view I have discussed on these problems? In the broad view, with many differences of degree and emphasis, there seems little doubt that man's place in the stream of evolutionary development is a prime determinant both of the possibilities of individuality and of creativeness of the human individual. Above all, socio-cultural evolution operates in the direction of creating more extensively the conditions underlying this individuality.

Without reference to any problems of what sources of "inspiration" may exist outside our present range of analysis, there seem to be included within this range several sources of individuality and uniqueness which are, for the most part, not interferences with but positively products and conditions for the further development of the socio-cultural nature of civilized men. In the first place there is ample evidence that however firm the biological pattern of the species-type, every higher organism is clearly unique, both in genetic constitution, and in the effects of the interaction of this constitution with a unique combination of environmental influences. Then, on top of that, in socio-cultural terms, no two human individuals have ever had exactly the same life-experience. The differences of their life histories differentiate persons; they ordinarily have greater similarity at the starting point than at any successive stage. Then in its relations to the outside world at any given moment, any given personality is socio-culturally different from any other. Finally just as truly, the complexity of civilized human personality means that the

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internal combinations of its constituent elements are endlessly varying and never the same in two individuals.

Thus the trend of the evolution of behavioral systems on the social and cultural levels is, in making them more differentiated and complex, to make them at the same time more differentiated from each other. But at the same time the condition on which this individuality rests, if it is to be combined with stability, is the *organization* of the differentiated units in a system of interdependence. The civilized levels of differentiation and hence individuality of human personality are only possible because social organization has reached levels of complexity and integration which are impossible on lower levels. Again there are many variations and there may be regressions in particular cases, but primarily individuality is a function of the level of social organization and the generalization and elaboration of cultural values.

Much the same considerations apply to the problem of creativity. An essential condition of creativity is the interaction of many elements in complex ways so that combinations which at the same time are valued and are statistically improbable have an opportunity to emerge. Creativity is above all the antithesis of the adaptive security to which I referred a short time ago. Creativity, like individuality, often stands in opposition to specific social and cultural pressures for conformity. But in the larger sense it cannot be a product of opposition to the level of the elaboration and differentiation of the social and cultural systems; it is on the contrary a direct outcome of these.

The above considerations apply in the first instance to the individuality and creativity of the single human being. But there is in this respect an essential parallel between the individual and the society. The view of the social element in the nature of man which I have put forward is one which does not set narrow limits to human development. In terms of biological constitution modern man is, by all indications, very little

different from his ancestors of prehistoric times. In his personality, however—that is, in his social and culturally formed acting self—he is enormously different; he has different values, wider horizons, greater potentialities. His future is an open-ended future the exact shape of which cannot be foretold, though we can discern a certain broad direction in the movement.

I think it can be truly said that our age is in the course, often painfully and haltingly, of developing a new view of man. The aspect of this new view which I have undertaken to stress is the relation of human society and its culture to the personality of the individual. In fact this is not merely a relation; actually the social environment, which is culturally formed, has become a constitutive part of personality. Man's thought is an integral part of his culture, and if his culture is, in a critical sense, a part of himself, then the development of that culture, with his view of himself as part of it, will lead in the course of time to change and further development of his very nature. If we can speak correctly of the emergence of a new *view* of man, such a new view may legitimately be regarded as both a symptom and a partial determinant of the emergence of a new *type* of man. Man is not a static entity but an evolving one, and cultural man, in however small a way, is beginning to play, on a level never before attained in the great sweep of organic evolution, an active, creative role in his own evolution.

THE NEW USE OF THE WORD

Douglas Bush

I AM HONORED and happy in being invited to share in Michigan State University's celebration of its first hundred years; and even a visitor can share in the satisfaction that crowns a century of remarkable growth, the attainment of both magnitude and maturity.

The title assigned to me was made comprehensive and elastic enough to cover anything one might feel moved to say about the role of literature and the writer in the past century and the present. The trouble is that there is far too much to say. A survey of literature means the survey of everything else as well, of our total civilization and culture, because the subject matter of literature is the whole range and texture of human life, the material conditions of existence, all that man is and does as an individual being, his desires and ideals and joys and fears and sufferings and defeats and victories, and, along with that, all that he experiences as one of a family, of a community, of a nation, of the human race. While such headings apply to man and literature in all ages, literature at once reflects, opposes, and creates the spirit of every particular age; and modern literature, the literature of the age of anxiety, has been preoccupied with man's increasing consciousness of his loss of outward and inward wholeness and order, with his sense of being a fragment in a fragmentary world. Thus a discussion of literature requires an omniscient deity; the story of natural science is, by comparison, a simple, straightforward story of progress along one road.

As even these opening remarks have indicated, our road or

labyrinth is paved and hedged with generalities and clichés, and we shall, as we go along, have to deal largely in both—remembering if we can that a generality, if true, is an unqualified truth, and that a cliché is a real truth grown too familiar to be felt as it should be. However, we might start from some concrete facts. Since our gaze is focused on this past century, we might recall the chief works of literature that were published in 1855. (Here and later, I may say, examples will be drawn mostly from English and American literature, since they are more generally known and illustrate clearly enough the movements we are concerned with.) The chief works of 1855 were, then, Matthew Arnold's *Poems: Second Series,* Browning's *Men and Women,* Tennyson's *Maud,* Longfellow's *Hiawatha,* and Whitman's *Leaves of Grass;* in fiction, Dickens' *Little Dorrit* (which began to appear in 1855), Mrs. Gaskell's *North and South,* Trollope's *The Warden,* the first volume of the Barsetshire series, Melville's *Israel Potter,* Meredith's satirical extravaganza *The Shaving of Shagpat,* the first adumbration of his ethical creed; in history—which was still a branch of literature and not a social science—the third and fourth volumes of Macaulay's *History of England.* It is a pretty impressive list, and, unless the remainder of 1955 has a great deal in reserve, it will come nowhere near matching 1855. Of course a different pair of years might yield different results—though one may hazard the remark that at the present moment there are more talented small writers, and fewer big ones, than there were a century ago.

Although one year's output is a random and inadequate basis for generalizing about the preoccupations of an age, we might glance back at the main themes and attitudes some of these books represent. The poetry of Arnold embodies the gropings and despairs of a man cut off from traditional religious answers and seeking some ground to stand on, some principle of order to cleave to. Browning, with an assured if unorthodox faith, is a fascinated explorer of both normal and

twisted personalities; and his realism and colloquial manner and rhythms were to make him a formative influence upon modern poetry. The neurotic hero of *Maud* is a rebel against the Mammonism of society, a victim of semi-Freudian psychological conflicts, and—as I have observed elsewhere—one of the mid-Victorian "lost generation," a sort of Hemingway character who oscillates between apathy and violence, love and death, self and a selfless cause. *Leaves of Grass* was a proclamation of faith in America, democracy, and the common man, in the glory of energy, work, nature, and sex. Melville, though *Israel Potter* is hardly representative, had a less simple and exuberant view of man and nature, and critics have not agreed on the question whether his white whale is divine or diabolical or both. *Little Dorrit,* a dark picture of greed, oppression, and religion hardened into *rigor mortis,* is centered in the economic and social abuse of the debtors' prison but extends to the less remediable imprisonment of states of mind. *North and South* deals with the painful impact of the new industrialism upon individuals and society. Macaulay's *History* celebrated the overthrow of tyranny and the winning of political and religious freedom.

These few books are, incidentally, enough to expose that stubborn myth about the comfortable uniformity and security of the Victorian outlook—and we may recall that the Marxist manifesto appeared in 1847 and *The Origin of Species* in 1859. But what concerns us is that the themes of the literary works anticipate the themes of much modern literature, that their authors belong more or less to our world, to our age of anxiety. There is some cold comfort in remembering that. (We do not, by the way, need to remind ourselves that Dickens, for all his grim ferocity, is one of the world's great humorists, and that the humorous sanity and insight of Trollope have helped to keep us sane.) A great deal of modern critical and social commentary has said or implied that our ugly and unhappy world is an altogether new thing, that mod-

ern man is overwhelmed by problems that did not exist for earlier generations. It is true that two world wars and the fear of a more terrible third, and rapid and radical changes in knowledge and thought and in our everyday life, have brought about an unusually drastic break with the continuity and apparent stability of the past; yet the literary spokesmen of the past, as exceptionally discerning members of their generations, did see and face comparable breaks and crises. We have, to be sure, created atomic and hydrogen bombs and can for the first time contemplate wholesale annihilation—perhaps not without the occasional feeling that it might be a good thing—but, apart from these inventions of scientific militarism, do we really have so many problems that did not confront our ancestors also? Some of them are as old as human thought; others are new only in their degree, their widened or intensified pressure.

We could spend this hour merely in cataloguing changes that have taken place in our ways of life and thought in the course of this past century, but perhaps most of them can be summed up under three headings: the rise of the common man, advances in science and technology, and the weakening or decay of traditional religious faith and religious sanctions for morality. And one has only to label such main movements to realize that they have been central movements in all history. The rise of the common man is a continuous fact from the early ages of Greece and Rome through the history of western Europe and the shorter history of America; and, more lately, there has been the upsurge of the East against both internal despotism and imperialism. (The adoption of another kind of despotism and of imperialism is another story.) The rudiments of science and technology are older than history, as modern anthropologists have shown in regard to primitive peoples of the present, and science and technology proper began in China and Babylonia and Egypt and Greece. The undermining of religious and moral orthodoxy by philo-

sophic scepticism is one of the first things we encounter in Greek history. One apologizes for recalling such commonplaces, but, as I said a minute ago, many people, sometimes with exaggerated self-pity, have dwelt upon the supposedly unique and staggering problems and complexities of our time, and one must emphasize the fact that the human race has always, in some fashion, been facing our problems, and has always, as in Thornton Wilder's play, survived by the skin of its teeth.

All three of our large facts or headings can be classified, according to what aspects or phases we look at, among both the Good Things and the Bad Things of history. Our great immediate danger, which weighs upon the modern writer as well as the mass of mankind, is a special combination of all three—the scientific means of universal destruction in the hands of a "people's state" founded on anti-Christian principles. That menace—coupled with the often frightening words and actions of our own well-meaning leaders—is too much in our minds to need elaboration, but we might remember that it evoked a high-souled declaration of ethical and literary faith from William Faulkner on the occasion of his receiving the Nobel prize. One can hardly imagine, by the way, what a change might possibly be effected in the conduct of national and international affairs if statesmen and legislators were to read every year a single great work of literature.

To return to realities, when we think of the rise of the common man we may think first of the slow amelioration in England of the hideous serfdom of the industrial revolution and of the achievement of economic and political strength sufficient, in modern times, to put Labor governments in power; in the United States we think of our constitutional democracy, of the attainment of a high standard of material well-being, of what is called a classless society, and of education for all. Such things, whether fully accomplished or not, are on the credit side of the ledger. Yet even the most bene-

ficial and necessary changes may involve protracted growing pains. Less than a century ago Matthew Arnold made it very clear that, as the English middle and lower classes were winning new political and social power, they must have more and better education; the choice was between culture and anarchy. And he, like other visitors to the United States, discerned in our culture an ominous contentment with mediocrity. American culture has risen since then, and at its best equals the best of Europe (whether or not that has declined), but our general problem is more pressing than ever, both internally and because of our new international responsibilities. While we all believe in universal education and hope for its ultimate success, the plain fact is that the immense growth of the school population in the past half-century has been attended by a shocking decline in educational standards. As a result of the downward pressure of sheer numbers, and of pernicious educational doctrine, the ideal set for education has been, not the highest, but the lowest, common denominator. The ground lost will no doubt be recovered in time, but not soon.

Thus one consequence—as we hope, not a permanent consequence—of the rise of the common man and the spread of minimum literacy is the gap or the conflict between mass civilization and minority culture and the partial submersion of the latter. While this cultural gap has been developing over a long period, and doubtless existed between pre-Homeric bards and their audience, only in recent times has it become so wide as to leave the serious writer more or less cut off from the community at large. Of course in any age a writer in a radically new mode may have to educate his audience, but in the past he generally knew that it was there to be won; the modern writer, rightly or wrongly, has not felt sure that it was there. It is obvious that the directors of our mass media, and many advertisers, politicians, and others who must please to live, assume the mental age of the public to be about four-

teen, and, moreover, are quite at home with it. The intellectual and cultural standard is again the lowest common denominator—whatever occasional efforts are made to rise above that level. Within the last few years we have seen in this country of popular education how powerful anti-intellectualism can be; for many people, education and intelligence are the first steps toward the pit of Communism, and the ideal of good citizenship is ignorant and intolerant conformity.

All these things being so, the modern writer has often worked with a chilling and baffling uncertainty as to whether he was communicating with his fellows or talking to himself. Compare, for example, the size and kind of audience that read *In Memoriam* and *Idylls of the King* with the audience that has read Mr. Eliot; to refer to the contrast is not to bestow praise or blame upon either poet or public, it is only to state a fact, and the comparison is logical because Tennyson saw a waste land in some respects much like Mr. Eliot's. The tendency of the serious modern writer to turn away from a nebulous general public to a small elite has been bad for the public, for the elite, and for the writer—who would surely prefer a large audience if he could get it, as Mr. Eliot's theatrical ventures indicate. The writer addressing cultured coteries may be led into eccentric arcana and a semiprivate idiom, whereas the greatest literature has drawn strength and universality from its popular roots. On the other hand, in our time of mass communication, the popular is commonly only the vulgarized; and the poetry of our time has been, for various reasons (among them the debasement of language), inevitably more difficult than that of earlier times. A partly similar predicament confronts the modern writer of serious fiction, although story-telling has always been, along with drama, the most popular of literary forms. The great and less great modern novelists, such as Proust, Gide, Mann, Kafka, Conrad, Joyce, Virginia Woolf, Forster, Faulkner, Heming-

way, have had no such universal public as Dickens had, though a few of these did in time win a general hearing. Indeed the number of readers of contemporary poetry has grown much larger than one might have predicted a generation ago; and, whether as a partial cause or consequence, or because we have gained understanding, poetry seems of late to have been growing simpler and more popular, in the good sense of the words.

The modern dramatist, working in the commercial theatre for a heterogeneous audience, appears somehow to have partly escaped or surmounted the general difficulties we have been observing. John Gassner, in his recent book *The Theatre in Our Times,* calls attention to the revival in modern drama that is in conspicuous contrast with the general flatness or concavity of the preceding century or two. "The combined work of the English writers overshadows anything written for the stage in England from 1700 to 1890. Ireland . . . had no drama to speak of before 1902." In Russia, Central Europe, Italy, Spain, and France almost all great modern drama belongs to this half-century. In the United States, before 1900, there were at best two or three acceptable plays to be set against "the work of O'Neill, Anderson, Howard, Rice, Behrman, Wilder, Green, Hellman, Odets, Williams, and Arthur Miller." One reason for this phenomenon Mr. Gassner sees in the fact that the film and radio have drained off much of the trash that used to be put on the stage—which is less reassuring in regard to the millions who are reached only through mass media. And, while Mr. Gassner finds encouragement in a long view of the drama, he does not find much anywhere in that of the last fifteen years or so. In 1946 Eric Bentley was "tempted to say that the theater at present fulfills only one precondition of renascence; it is dead."

The obverse aspect of the cultural situation has also had far-reaching effects upon literature: this is related, not to the rise of the common man, but to the rise of the specialist.

From Graeco-Roman times up through a good part of the 19th century the mass of educated men had a more or less uniform kind of education, based on the classical tradition, and that still prevails to some degree in Europe. But, especially in this last half-century, the relative homogeneity of education, knowledge, and culture has given way to diversity and specialization. The fifty departments of a modern university faculty are aggregates of electrons moved less by attraction than by repulsion; and the educated public, in its degree, tends to be an aggregate of heterogeneous groups that do not speak the same language, that share only a minimum of common culture. But the very existence, or at least the health, of art depends upon a common culture; the artist addresses *homo sapiens,* man as man, not *homo faber,* the technical expert. But where is the community of *homines sapientes?* We would like to say it is in the colleges and universities, but are we quite sure? We might think here of the so-called "new criticism," which in practice if not in theory is based on the premise of an academic elite, in contrast with the traditional appeal of criticism to the commonwealth of letters. The rise of university presses, which now publish books that in former times would have been issued by regular publishers (if issued at all), is another reminder of the sometimes lumpy seams in the modern robe of truth—which is not to disparage the invaluable services of the academic press.

And that brings us to our second topic, the position and the function of literature in a world dominated as never before by science and technology. The direct and indirect results of science and technology upon the lives and minds of all of us, and hence upon the artist and art, are at once numerous, obvious, subtle, and complex. And let me say once for all that, in trying to summarize some central facts and implications, I am not setting up science as the devil of the modern world; our infinite and continuing debt both to scientific thought and discovery and to practical applications

does not need to be dwelt upon. But it is clear to all, and not least to scientists, that scientific discoveries are infinitely easier than the achievement of effective moral wisdom, and, while there are those who see a cure for all our ills in more science, it is not obscurantism to maintain that science is by no means the only or a sufficient oracle and guide. Certainly a blind faith in evolution, which cheered many thinkers from the early 19th century up to the first world war, does not cheer many nowadays.

Although, as we observed, there has always been something of a gap between the artist and society, the first real split seems to have come with the industrial revolution. Until that time, in spite of some scientific and technological advances and the growth of cities, man's way of life, even in Europe and America, was not unrecognizably different from that of all the centuries stretching back to biblical Judea and beyond. But this past century and a half has mechanized our lives and our outlook. The alleviation of man's estate has far exceeded Bacon's dreams, but with losses as well as gains. Thanks to medicine, man's life-expectancy is much lengthened—if he is not one of the millions who die in modern wars and on the road. And we might remember Arnold's remark about the train that takes one swiftly from an illiberal, dismal life in Islington to an illiberal, dismal life in Camberwell. At any rate, without forgetting the immense gains brought about by technology, and without silly sentimentalism, we must admit that the old way of life was natural, and that life in the modern industrial megalopolis is unnatural. That is, a man and his family are no longer, even in the country, a self-sufficient community, living close to a stable tradition and the processes of nature, but are mobile, isolated, rootless atoms, dependent upon a multitude of external agencies. Unless he makes a determined effort, an effort that invites the label of eccentricity, modern man loses the use of his hands and his feet and his senses, not to mention the time and capacity for reflection.

Art, on the other hand, however subtle and complex it may be at any stage in its long history, starts from the natural activity of man's natural faculties; its primary language is the language of sensory images and symbols; its values are not the values of a mechanized, acquisitive society.

To speak of these things is to be reminded of Wordsworth and the whole romantic revolt against the mechanized conception of both the universe and the human psyche which the 18th century had developed, and against the mechanized society that was in the process of developing. Part of our debt to Wordsworth is for his revitalizing of man's senses and natural feeling. In the words of Arnold's tribute, Wordsworth shed

> On spirits that had long been dead,
> Spirits dried up and closely furl'd,
> The freshness of the early world.

Wordsworth clearly recognized, in his Preface of 1800, the benumbing effects of urban life and uniformity of occupation and the consequent craving for unnatural excitements. He also made a prophecy that points to the enlarged responsibility of the modern poet: that scientific knowledge and discovery must become as proper material for the poet as any other, whenever it should become a familiar part of the experience of man as an enjoying and suffering being.

Modern poets, compelled to feel more strongly than Wordsworth the oppressive dangers of mechanization, torpor, and corruption, have been drawn in two ways, toward revulsion and escape and toward acceptance and assimilation. If I may mention such a bard as Kipling, a pioneer of eager acceptance, I have, after thirty years, a vivid memory of a half-hour in the bowels of an Atlantic liner when a Scottish engineer explained the machinery, and we recited antiphonally the lines of *M'Andrew's Hymn* while he pointed at every part as it was named with joyful recognition of the poet's accuracy:

Lord, send a man like Robbie Burns to sing the Song o' Steam!
To match wi' Scotia's noblest speech yon orchestra sublime
Whaurto—uplifted like the Just—the tail-rods mark the time.
The crank-throws give the double-bass, the feed-pump sobs
an' heaves,
An' now the main eccentrics start their quarrel on the sheaves. . .

But recent poets could not rejoice in engines with Kipling's Homeric gusto (that sort of thing is left to science fiction). They have been too realistic to turn away, like the Pre-Raphaelites, into art for art's sake; and they have broken down a restricted conception of the "poetical" in theme and manner and have sought an all-embracing inclusiveness and the language and rhythms of common speech (rhythms, one may add, that have been related to the internal combustion engine). At the same time the modern poet, while accepting science *per se,* was bound to discern and react against all those elements of a scientific and technological civilization that would dwarf and deaden his humanity and individuality and make him an insensitive, mechanical fragment of a noisy, inhuman chaos. That is one reason why Blake has been so potent a voice in modern times.

Thus while the Whitmanesque impulse in Hart Crane could celebrate the significance of Brooklyn Bridge, there is nothing exhilarating in Mr. Eliot's or Mr. Tate's—or Crane's own—vision of the subway as a symbol of life that resembles Dante's hell; nor is man's conquest of the air the theme of Stephen Spender's *The Landscape near an Aerodrome.* Whereas Wordsworth could greet the hushed evening with natural piety—"The holy time is quiet as a Nun/ Breathless with adoration,"—the best-known image in modern poetry is that of the evening spread out against the sky "Like a patient etherised upon a table." (For an image more typical of the later Eliot, there is the great lyric in *Little Gidding* in which new and old come together, the fire of the bombing plane fused with the fire of lust and the fire of purgation.) In most

modern poets there is, in or between the lines, a consciousness of the dehumanizing forces that press upon modern man; and there is also a reassertion, however oblique at times, of his human dignity and vitality.

If, here and elsewhere, I give undue space to poetry, it is because time is limited and because poets above all distil the quintessential spirit of man. But other forms of writing manifest, often more directly, the same fear and hatred of what an industrial and mechanical civilization can do to the individual and to society as a whole. No modern writer has surpassed the largely pre-mechanistic Dickens in his surrealist, nightmare vision of the great city and the millions who compose the lonely crowd. A common inhumanity links the London of Eliot and the Dublin of Joyce and the big cities of Dreiser and Dos Passos and Farrell. Some writers have projected mechanical stereotypes, the slaves of a shallow or sinister conformity or automatism, such as the robots of *The Adding Machine* and *Back to Methuselah.* And the decline of love, among some portions of humanity, into biological mechanics was registered, long before Dr. Kinsey, in *The Waste Land* and other works. I might quote from Lionel Trilling a sentence I am fond of, which illustrates a mechanized psychology: "A specter haunts our culture—it is that people will eventually be unable to say 'They fell in love and married,' let alone understand the language of *Romeo and Juliet,* but will as a matter of course say 'Their libidinal impulses being reciprocal, they activated their individual erotic drives and integrated them within the same frame of reference.' "

Some related questions come under the head of science. One is another aspect of the split between the artist and society. From antiquity up at least through Milton, the imaginative writer, above all the serious poet, was an acknowledged teacher of mankind; though the world might be more or less philistine, he had the personal confidence and the public respect given him by the authority of a great tradi-

tion; and in general he shared, even while he purified, the values and ideals of the best part of his society. No doubt, and happily, that is still true of modern poets, but in a far more limited and uncertain way. While the industrial revolution was going on, Wordsworth could reassert the high role of the poet as teacher, but his disciple Keats was torn between the claims of social responsibility and aesthetic detachment. That tension was the theme of many of Tennyson's early and best poems, and it was felt by Browning and Arnold. Then came the Pre-Raphaelite withdrawal into aestheticism—while in America Whitman declaimed public poetry and a social gospel. The continuance and complications of the problem in our time were attested by the dispute over the Bollingen award to Ezra Pound: is the artist responsible for his ideas if these outrage enlightened opinion and, in war-time, give aid and comfort to the enemy, or is he responsible only for the aesthetic qualities of his art, which may survive long after the ideas have lost their effect? If we accept the first alternative, we reject some notable artists who have been poor citizens, and we forget that heretics are sometimes proved right by posterity; if we accept the second, we make the artist a mere artificer and reject any serious claims of art to be a central element in human life.

The importance of the artists' role in the modern world has been questioned in another way by the steadily rising claims of science and scientific philosophy. The issue was plainly stated more than three centuries ago when Bacon, the herald and philosopher of modern science, contrasted poetry, as wishful thinking, with the scientific investigation of reality. However, after two centuries of scientific advance, the romantic poets were still able to take their stand with confidence on the poetic imagination and intuition; indeed, as Whitehead pointed out, their intuition was profound enough to abandon a clock-like for an organic universe long before the scientists did. In the modern world in general, art and

science have been accepted as two ways of attaining truth, each a form of cognition valid in its own sphere. But the scientific and positivist mentality of our times, recently exemplified, after a fashion, in Kathleen Nott's *The Emperor's Clothes,* has disparaged or denied intuition and insisted that there is only one road to truth, the scientific—a conclusion that leaves art either a dependent of science or an insignificant amusement. So far as my observation goes, it is not so much the working scientists who have made these exclusive claims but the positivist philosophers who live off the scientists and for whom all truth is logical and algebraic. On the higher levels, there may well be a point where the scientific and the artistic imaginations meet; on the lower levels, science and art commonly collide. The modern artist, in standing on the validity of art, is in opposition to the general spirit of the age, which inclines to accept anything really or supposedly scientific as oracular and final.

To turn to another area of science, Freudian psychology appears to be one of the chief watersheds between modern and earlier times. (We may use "Freudian" as a shorthand label for both Freud's and other current doctrines.) Certainly modern writers, Joyce and Lawrence and O'Neill and others, have more or less absorbed and used the principles of modern psychology, and words like "complex" and "maladjusted" have become part of the language of the street. Literature has been less concerned with Freud's therapeutic counsels than with his emphasis on man's instinctive drives, on the depth and strength of the irrational urges in human nature—urges also emphasized, we might remember, by moralists from Plato and Aristotle down. In a remote and general way this emphasis on the irrational in human nature links itself with the modern physicist's abandonment of strict regularity in external nature for the indeterminate, the not precisely calculable. I do not think, I may add, that those modern literary critics have been wisely led who have reasserted, with psy-

chological support, the doctrine that art is the product of neurosis and the artist the sick man of society; the doctrine may help to explain a number of writers of the last century and a half, but it hardly fits the great ancients or Chaucer or Rabelais or Shakespeare or Milton or many others of notable sanity.

Psychology itself is naturally full of conflicting theories, and the excursions of professional psychologists into literary criticism have seldom been happy, though we are not concerned with them. Literary criticism proper, seizing eagerly upon the new tool, has employed it with both fruitful and fantastic results; so far the latter have perhaps been more conspicuous. Some critics have found sexual imagery in the most alien contexts. Some have used frustration as an automatic key to a crowd of authors. Many have been seduced into reliance upon readymade formulas and pigeonholes, not to mention a great deal of painful jargon. And at times imaginative writers have been inclined to let a textbook case-history serve as a substitute for creation. It seems to me—though I may exemplify popular ignorance and misunderstanding—that so far the modern marriage of psychology and literature has on the whole been less than fortunate in its progeny and has led to more confusion, or more specious clarity, than illumination. My son, who so often enlightens my darkness, tells me that credit should be given to psychology for, among other things, the prevailing seriousness of modern literature. And of course modern criticism owes much of its seriousness and its analytical method to the psychologist I. A. Richards.

To think of psychology is to think also of psychiatry and of the widespread faith in it for the curing of a multitude of private ills, and that brings us to our third large fact, the weakening or decay of religious belief and of religious sanctions for morality. Many people would no doubt deny at once that this is a fact. Still, we can say with some confidence that at the present time most educated persons, including writers,

fall into one or another of three groups: first, more or less orthodox Christians, liberal or authoritarian; second, agnostics of various kinds who reject the idea of religion and hold a purely naturalistic creed; and, third, those wanderers between two worlds who cherish the Christian tradition and outlook and—to borrow a phrase from Charles Williams—without being themselves Christians are opposed to those who oppose Christianity.

There is no need of rehearsing the story of how we got that way, or how much modern science, in fields as diverse as astrophysics and biblical criticism, contributed to widen the hold that naturalistic scepticism had exercised for many centuries. Nor is there any need of elaborating such modern clichés or realities or exaggerations as "the failure of belief," "the breakdown of values," and the like. Modern writing of all kinds attests general and deep-seated confusion. At the same time—and this is not a flippant remark—almost every commentator on the present state of man gives the impression that his mind is clear but that other people are confused. (I hasten to say that on many things my mind is not clear.) Thus, while it is axiomatic that all moderns are in a state of moral confusion, one never meets any particular person who is. However, it would hardly be disputed that, of all the changes modern man has encountered, the most central and devastating has been the loss or the lack of religious belief and religiously grounded morality. That was a tragic experience for writers and others in the last century, but the commoner experience of our time has been rather the consciousness of having no religion to lose, no soul to save, of drifting on a foggy sea in a leaky ship without rudder or pilot. For most people of any imagination and sensitivity there is an urgent need to believe in something beyond and above the self, to transcend the world of flux, and the sense of inner and outer chaos or emptiness has inspired various reactions—joining a group or party in order to "belong," absorbing one's self in artistic,

professional, or humanitarian work, the quest of some personal creed that will give a dynamic center to life, the cultivation of indifference on a low level or, on a higher level, the willing or conscious suspension of belief.

The general situation is underlined by the diversity and idiosyncrasy of such creeds or attitudes as can be extracted from many writers of our time or older writers especially esteemed in our time, such as Dostoevsky, Stendhal, Baudelaire, Rimbaud, Proust, Gide, Rilke, Kafka, Blake, Joyce, Lawrence, O'Neill—all of whom, along with others, may be described as in one way or another "off-center." And the addition of such likewise admired writers as the decorous James, the Puritan Shaw, the Anglo-Catholic Eliot, the "unchristened" Yeats, the sanely sceptical Frost, and the doubtfully classifiable Faulkner and Hemingway would still leave a picture of individuals more or less isolated from one another and from society. If it be said that diversity was an obvious fact in any former age, one may think that there was at any given time in the past more of a common substratum of normal experience, belief, and outlook among writers themselves and between writers and the mass of educated readers.

In this large area we can look only briefly at two or three topics. Since we touched on psychology, we might begin with the conception, identified with Jung and enlarged from anthropology, of archetypal myth, the embodiment in story of universal and timeless situations, experiences, and feelings, filtered through the collective unconscious or racial memory. Whatever anthropologists may say of the scientific validity of the doctrine, it has at least a limited and unimpeachable validity in having contributed so much to the technical innovations of modern literature—witness such seminal works as *Ulysses, Finnegans Wake, The Waste Land,* and the poetry of Eliot and Yeats in general. The case of Yeats is at once peculiar and typical of the predicament of the modern writer.

A man of religious and anti-rationalist temperament, but cut off by Darwin and Tyndall from traditional faith, Yeats began as a Pre-Raphaelite dreamer in the twilight of Celtic myth; then, impelled along various occult paths of thought, and steeled by personal and national tensions, he evolved the elaborate pseudo-historical and mystical system expounded in *A Vision;* and on this ramshackle foundation he built the realistic and magnificent structure of his later poetry. No one could ever believe in the system, but in some sense it satisfied the poet's need of a belief, even if it was not much more than a treasury of rich and coherent symbols.

The modern conception of myth has, like psychology proper, given a new tool to the criticism of not only modern but earlier literature. One recent and comprehensive example is Professor Herbert Weisinger's analysis of the tradition of tragedy. But we cannot pursue the general idea, which appears everywhere in modern criticism—sometimes guiding its exponents in the form of a pillar of cloud. I speak of the matter under the heading of religion because, along with its strictly literary applications, it has ministered to the modern craving for a sense of tradition, of enduring reality and community of experience—those human necessities which our industrial and urban civilization has so largely exterminated.

At the other end of the scale we have had what might not have been expected in an ultrascientific age—though perhaps it is just what might have been expected—namely, the revival or reinterpretation of traditional Christianity, Catholic, Neo-Calvinist, or liberal. The pioneer of "crisis theology," first really discovered in recent decades, was the 19th-century Kierkegaard. The many-sided modern movement has been led by such philosophic theologians as Barth, Niebuhr, Tillich, and Maritain. What more directly concerns us is that some writers of various kinds and varying stature have returned to Christianity; and a very few had not left it.

In England, in addition to Eliot, whose literary eminence and influence have done much to make religion respectable, there are such others as Graham Greene, C. S. Lewis, and the late Charles Williams and C. E. M. Joad, and one must include, not without distaste, Evelyn Waugh; in France there have been such writers as Claudel, Péguy, and Mauriac; in the United States the late Paul Elmer More and F. O. Matthiessen, Allen Tate, W. H. Auden, and other writers and scholars. Among several possible comments, one is that recent converts have in the main embraced the Catholic form of faith, the form farthest in some ways from the intellectual temper of our time. Another comment might be that such a desire for order in the midst of flux inspired similar conversions among Continental romantics in the early 19th century, a fact that does not in any way impugn the genuineness of either phenomenon, whatever dubious fringes there may be.

This religious movement has had a significance for literature out of all proportion to the number of writers involved, because it is at once an agent and a symptom of a partial but manifest change in the spiritual climate. The gritty and dogmatic rationalism of many Victorian and modern liberals has only repelled these moderns who have felt acutely the reality of evil, the consequences of secular, self-sufficient pride. Literary criticism has of late added to its vocabulary such novel terms as not only evil and pride but guilt, sin, grace, redemption. For "fellow travelers," Christianity has appeared as the supreme archetypal myth of the human situation; a recent version of that is Faulkner's *A Fable*. If a change of heart and direction in a few has led, among the many, to more religiosity than religion, even dubious manifestations imply a more serious and healthful state of mind than the brash liberalism or cynical defeatism or village atheism of earlier times. And this state of mind has been conspicuous among college students of literature, many of whom now read Dante

and Herbert and Milton and Hopkins and Eliot with a responsive sympathy that would have been almost inconceivable thirty years ago.

While in traditional Christianity and the higher religions in general, belief and righteousness have gone together, the modern religious movement among men of letters may seem at times to exalt the Incarnation and the sacramental and to slight the Sermon on the Mount. In regard to the whole question of moral values and conduct, recent generations of those outside religion appear to have found no firm basis for traditional morality, no acceptable guide for personal problems. The most confident claimants for the moral direction of modern man are the psychologists and sociologists, who can no doubt contribute. But I cannot help recalling a pronouncement made a number of years ago by a psychologist to a gathering of prison wardens, that the idea that man is responsible for his behavior belongs to the age of witchcraft. Would it be illogical to suggest that the speaker was not responsible for what he said? Such an utterance may not be typical of the highest scientific wisdom, but it is typical of the scientific sentimentalism that we have had all around us for a long time. And perhaps another item might be added: an old *New Yorker* drawing which showed a thug explaining to the police that he hadn't had the right vitamins. In this general connection one may cite a more sober and particularly impressive testimony from a non-religious writer, Joseph Wood Krutch. In his book of 1929, *The Modern Temper,* Mr. Krutch, surveying science and literature in the postwar and defeatist era, seemed to acquiesce, sadly, in the stripping from man of his traditional moral and tragic dignity. But in *The Measure of Man* of 1954, Mr. Krutch was stirred to earnest assertion of man's rational and moral dignity and responsible power of choice against the more or less behavioristic and deterministic doctrines developed out of Marxism, Darwinism, and modern psychology.

I am myself no sage, far from it, but I venture in concluding to make some suggestions which may sound more naive than the psychologist's pronouncement that I quoted. While I have tried, so far as I am able, to outline the modern literary situation, I think that on the whole our writers and their more sophisticated readers have been—under heavy pressure, admittedly—a little too ready to enroll themselves among the alienated and disinherited, to turn away from fundamental things in common life and in age-old tradition. I would say that the great heritage of experience and wisdom and beauty, the great sources of strength and guidance, are still there to be drawn upon, if we will but turn to them and not be misled by the fallacy that they are obsolete or inadequate. I think also that writers and readers of our time—one of the unheroic or anti-heroic phases in the cultural cycle—have been rather too much attracted to those writers who embody or encourage confusion and despair and too little to those who have sought for order and fortitude and humility. Is it self-evident that the former are much more powerful minds than the latter?

Further, in spite of the endless talk about the complexities of the modern world, I would maintain that nine-tenths of the moral problems that confront the modern individuals are not more complex than those that confronted individuals in the past, but are on the contrary very much the same. And no matter how much psychologists and philosophers wrap things up, or cackle about a "scientific morality," the cases are very few in which we do not know the difference between good and evil. While we gratefully accept all the help that science can give us about the nature of man and society and the universe, it is in literature, in the ancient wisdom of the East and the long tradition of the West, in the richest insights of the richest minds, that we have the most direct and powerful illumination. We hear so much about vast impersonal forces tossing us around that we forget that such forces all come

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down to the question whether John Smith or Ivan Ivanovitch feels and thinks and acts rightly or wrongly, above all, whether he loves what all human experience has found lovable and sustaining. The only way in which most of us can help to curb or restrain those forces is by cultivating our own small garden.

It would appear that my text has become not so much the new use of the word as the old use of it. Yet there is no real difference, because "the word" is a timeless whole, continually changing in changing lights and continually augmented, but always concerned with the same ends. From the literary humanist's standpoint, the new view of man, if it is to be a worthy subject and goal, must be in very large measure the old view that we have never realized but that remains always before us, not behind.

I EDIT A LATIN TEXT

Arnold Williams

FOR THE PAST three years, my chief scholarly work has been editing Latin texts. I am not a teacher of Latin, and my training, which was in English literature, included little work in the Latin language, none in deciphering the writing used in old manuscripts, none on the tests used to detect forgeries and alterations, very little in the complicated rules of editing —in the sciences and arts professionally known as paleography, diplomatics, and textual criticism.

Like most people, even those who have Ph.D. degrees in literature, I took the printed word more or less as I found it. Of course, I knew that all good editions, say of Chaucer, have something called "textual apparatus." In the footnotes or at the back of the book, one found cryptic symbols like, "*armee* El Pw5; *arvye* HgEn¹GgHa." These, I knew, were variant readings, and the letters were shorthand for the designations of manuscripts; translated, the note meant that the Ellesmere, Petworth, and sigma group of manuscripts of *The Canterbury Tales* had the Knight at "many a noble armee," whereas the Hengwrt, Egerton 2726, Cambridge Gg. 4. 27, and Harley 7334 manuscripts had him in many a noble "arvye." You made the translation by looking at the list of the manuscripts which began the textual apparatus.

In my teaching I had tried to communicate to students some appreciation of all the work that went into the production of a text like that of *The Canterbury Tales,* and to give them some awareness of the problems encountered by those who sought to make available to the general public the works

of our older writers such as Chaucer and even Shakespeare. I admired editors, knew how how necessary they are, used their work every day. But I never intended to be one. My business was with ideas, literary criticism, literary history. If a reviewer could tell me what was the proper edition to use in classroom or for scholarly investigation, I would take his word for it. Down beneath there was a little contempt for editors, who were rather dull drudges working on the peripheries of literature.

How, then, did I come to edit—not English works with some claim to literary excellence, but Latin texts which could be brought under no conceivable definition of literature? The explanation lies, I suppose, in that fact that I am a scholar. A scholar is born with some glandular disarrangement which at unpredictable times forces him to doubt what the authorities, themselves scholars, tell him is the truth. He is a specialized variety of non-conformist, spiritually akin to the one crank who votes nay in town meeting when all his neighbors are voting aye.

Being so constructed, the scholar is likely to find himself in all sorts of situations which he has not envisaged and does not enjoy. That is how I got myself into editing Latin texts. A student asked me a question about Chaucer's friar, that artful hypocrite who thought that a large donation was better proof of repentance than bitter tears, who was better acquainted with innkeepers and rich merchants than with beggars and lepers, and who had a semicope of double worsted. It was that semicope that the student asked about. What was it doing in the description? All I could answer was that Chaucer had promised to tell what array the pilgrims were in, and that possibly the friar wore the cope to impress the ladies. Or maybe it was an ironic antithesis to his supposed poverty.

It was an unsatisfactory answer. The more I thought about

it, the more my shame grew. Just why I should be perturbed by this particular failure escapes me. Being asked something you don't know and making an inadequate answer happens every day to the teacher. Anyway, this question forced me, in order to appease my conscience, to read all the comments, both by literary critics and by historians, that I could come by. Something curious about them began to register, and the further I read the more curious it seemed. The authorities were in agreement that Chaucer was substantially right, not about a particular friar, but about friars in general. They were a bad lot. Vowed to absolute poverty and to service to the outcasts of society, they had deserted the ideals of their founders and become money-mad hypocrites who sold their absolution, flattered the rich and powerful, and so justly incurred the wrath of all who had a social conscience, including Geoffrey Chaucer.

Now I always find unanimity frightening. Could the evidence possibly be so overwhelming? In all my experience, that rarely happens. I have read treatises showing, or purporting to show, that Nero was one of the most successful of Roman emperors in the conduct of foreign affairs; that Richard III is regarded as a villain mainly because the sources which historians have depended on were written by partisans of Henry Tudor; and that if Stephen A. Douglas had won in 1860, instead of Lincoln, we would probably have been spared the Civil War. Before I die, I expect to see an attempted vindication, or at least a sympathetic revaluation, of Hitler. If scholars had made a case for Nero and Richard III, I could not help suspecting that their failure to make one for the friars was due rather to their ignorance than to the overwhelming evidence. Otherwise, why did none of the authorities quote, cite, or even mention any defense of the friars by a friar?

Within the next year I was lucky enough to get a Guggenheim Fellowship, which, with my sabbatical leave, enabled

me to spend a year in England, where the materials needed to answer these questions would be at hand. I was supposedly dedicated to another task, but everything I did seemed always to involve the friars. They were becoming an obsession. The scholar's word for an obsession is a project. Gradually I began running into all sorts of documents, some printed, but most in manuscripts, bearing on the friars. In about two months I was on ground apparently unknown to any of the critics and scholars whose opinions I had read. Evidently they had not known the documents I was turning up. And here was the reason that I had found no mention of defenses by the friars. They existed in plenty, but they were in unedited Latin manuscripts, whereas the attacks were in English texts capably edited and easily available.

If you want to catch a scholar, this is precisely the kind of trap you set for him. Give him a theory that, on the face of it, is one-sided. Insinuate that somewhere off the beaten track are to be found facts that contradict the one-sided theory. Add a bit of flattery in the form of the possibility that the solution of the problem is the application of some method, special bit of knowledge, or resource not possessed by competing scholars. It was a perfect trap. Before long I was arguing (to myself) that it was a job that desperately needed doing, that no one else gave any promise of doing it, that I had advantages that made me, of all students of Chaucer, precisely the right person to undertake it.

Against the undertaking was the undoubted fact that I had never had any training in the various skills needed by an editor of Latin texts; even my knowledge of the language was of the rough, working sort. If I could make sense of a piece of Latin, that satisfied me. The more subtle distinctions between tenses and moods, which verbs take the dative or the ablative, which words were bona fide conjunctions and which only connective adverbs—to such matters I had paid little

heed. And I was to discover through painful experience that these are the sort of things one needs to know if he is to reduce a medieval Latin text to the order demanded by modern scholarly editing.

My only answer to these objections was that you can learn these things; in fact you have to learn them, just as you have to swim if you jump in water over your head. (The other possibility, that you might drown, didn't occur to me then.) A scholar, I further assured myself, isn't required to know everything; he is only required to be willing to learn anything demanded by the task at hand. When Pasteur undertook to discover the nature of the disease afflicting silkworms, he had never seen a cocoon. I was better off—I had seen a Latin text.

Of course, I never went through so logical a course of reasoning. What I actually did was to begin collecting manuscripts. First, I discovered that one Archbishop FitzRalph had delivered in four sermons preached in London during the winter of 1356-57 a blistering attack on the friars. At the Bodleian Library in Oxford, at the British Museum, at Peterhouse in Cambridge, at Lambeth Palace in London I discovered manuscripts of these sermons. In all I found nine manuscripts, which meant that the sermons had had a popularity comparable to that of a modern book which sells half a million copies. There was also a printed version, published in Paris in 1512. This would be a great help, I thought. Only later did I discover the enormity of this misappraisal.

Other manuscripts, too, I found. The Cambridge University Library furnished one copy and Magdalen College, Oxford, another of an exhaustive reply to FitzRalph by a Franciscan friar named William of Woodford. Another reply was by a representative of still another order, the Austin friars; the Carmelites were represented by two defenses by Richard of Maidstone; and the Dominican reply to FitzRalph had

already been edited. Here was the other side of the argument, several hundred pages of it, so conspicuously missing in the authorities I first consulted.

Now, of course, this was entirely too much material for me to handle in the time at my disposal, if I had to read and copy all the manuscripts in the libraries that owned them. Fortunately, I could call on the greatest technological aid to humanistic scholarship, microfilm. In several hours I could read enough of the manuscript to assay its value. Also I could note all those features which would not appear on microfilm: the material on which it was written, whether paper or skin; the watermark, if it was paper; the folding of the material; and a great many other matters, all of which might be useful later. After all this information was collected, I could order a microfilm with the assurance that the document would be photographed by experts. I could then take the roll of microfilm back to the United States with me and read it at my leisure.

Most people, I suppose, when they think of medieval manuscripts, picture the lovely illuminated manuscripts which are featured in art museums and occasionally reproduced in *Life*. These gorgeous works, with their bright blues, reds, and greens and their ornamentation in pure gold leaf, are no more representative of the medieval book than the custom-built automobile is of American motor transportation. They were made for princes and rich burghers, and they cost, in our values, thousands of dollars. Most of the illuminated manuscripts are prayerbooks or stories of knightly adventure. The learning of the middle ages, the works of St. Thomas and of Aristotle, is preserved in manuscripts of a humbler sort, because the scholars who used them were, as scholars are now, poor men.

And it was with learning, with philosophy and theology, with the concerns of university men, that I was chiefly concerned. Of over a hundred manuscripts which I have studied,

only one could be called elegant. The manuscripts I work with are at best competently written on a satisfactory grade of parchment; at worst they are productions of hasty, careless, and only semi-literate scribes on inferior parchment full of cuts and scars and with ragged edges. An eminent Belgian art historian to whom I told what I was doing looked at me with pity. "You will lose your eyes," he said.

I soon learned how nearly right he was. Ability to read starts with the recognition of the letters. In the last six hundred years letters have changed their shapes considerably. Handwriting is subject to styles and fads like dress, and between the 14th and the 20th centuries lies one of the great changes in style, that from the Gothic hand, faintly imitated in the modern "Old English" type face, to the Italian. My manuscripts were all in hands not too far from the Gothic, though some were in the more running sort, appropriately called "bastard." I have used stronger terms.

The manuscripts were full of difficulties. Take, for instance, the minims, those vertical strokes that make up the letters *i, m, n,* and *u.* In my manuscripts the vertical strokes were heavy, the connecting lines faint to the point of invisibility. And it is the connecting lines that distinguish an *n* from a *u.* So two strokes can be either an *n* or a *u;* three can be an *m,* an *in,* an *iu,* an *ni,* or a *ui.* A few of the scribes sometimes indicated an *i* by putting a sort of dot (more like a curved accent mark) above it, but often this was not visible on the film.

The result of this sort of writing at its worst was something like this: ||||||||||||||| The problem is to find a word which consists of fifteen minims and which makes sense in the context without violating any rule of syntax or grammar. I don't know what par for such a problem is among professional paleographers, but it sometimes took me half an hour of counting minims, making experimental combinations, eliminating impossibilities, looking up words in one or all of the

three Latin dictionaries I kept on hand, and then construing the resultant trial sentence. The answer, if you are curious, is "minimum."

There were many such problems. In one manuscript the *e*'s and the *o*'s looked alike, distinguished only by a tail usually not more than a sixty-fourth of an inch long on the *e*. Most of the time this similarity caused no confusion, but occasionally either letter would make a word that yielded sense: either *emissio* or *omissio*. Sometimes the *a*'s and *d*'s were hard to tell apart. A double small *f* (used for the capital *F*) resembled a capital *A*. The *c*'s and *t*'s were often identical, since the *c* was made with two strokes, one coming down and curving inward, the other starting at the top and going horizontally to the right. The *t* was made the same way (and still is), except that the cross stroke started to the left of the down stroke, but it was easy to start the cross stroke of the *c* too soon or of the *t* too late.

Early in my work I was often puzzled to find that a manuscript that I had been transcribing at good speed suddenly became difficult. I would have to scrutinize each word, to puzzle and guess, to leave blanks. The explanation lay in the conditions of work of the medieval scribe. With experience I could often assign causes for these bad sections. The scribe's pen, made of course of a feather, had got soft or scratchy. When he cut himself a new one the difficulty cleared up. Or the batch of ink was too watery and had faded, or the parchment was rough and caused blots.

Other times the failure was human. The hand of the scribe became cramped from overwork or from cold, for fire was rarely allowed in the medieval scriptorium, because of danger to the books, and the temperature must often have been in the fifties, sometimes even in the forties. At times I felt sure that the scribe was getting towards the end of the day, and fatigue was blurring the neatness of his strokes. Some

scribes didn't dip their pens often enough; with predictable regularity the writing would grow faint.

A medieval manuscript is a very human piece of work, without any of the levelling-off effects which the machine brings to all craftmanship. You learn much about the character of the writer of a manuscript, whether he was careful or sloppy, imaginative or pedestrian. In one manuscript that I saw the scribe was terribly bored with what he was copying. To make the deadly task bearable he began doodling with his letters, fattening out the loops of *l*'s and *h*'s to form fish, prolonging the down stroke of the *p*'s into grotesque faces, and drawing eyes and nose in the capital *O*'s.

It was not, however, the forms of the letters that gave me the most trouble. It frequently required an hour or even two of intense intellectual effort to get accustomed to the letters of a new manuscript, but once I had got past the first two pages, I rarely had any more trouble. What usually threw me was the infuriating habit of the medieval scribe, especially in the poorer sort of manuscript, of abbreviating.

A utilitarian reason lies behind this constant abbreviation. In our world, time is the most important of commodities. Because time is what costs, our garage mechanics put in a new part instead of repairing the old one. We would think it a poor economy to reduce the number of pages of a book by half, if at the same time it took twice as long to read the book. Yet that seemed a very good exchange to the medieval. Readers had plenty of time; so did scribes; but there was not plenty of parchment. That, rather than human effort, was limited. So if the medieval scribe could save on his materials at the expense of his own and his readers' time, he did so. And the method he used was abbreviation.

Technically, abbreviation is of three principal kinds, by signs, by suspensions, and by contractions. By the end of the 14th century, scribes commonly used well over a hundred

conventional signs, which were really a sort of shorthand. To indicate a following *n* or *m* you could draw a bar over the preceding letter, *mā* for *man, āīa* for *anima.* There were signs for *-er* and *-ur,* for *-orum* and *-is.* A straight line through the bottom stroke of the *p* made it *per;* prolonging the loop of the *p* until it crossed the bar and then curved back to recross the bar further down made a *pro;* a bar over the *p* produced a *prae*—only sometimes where *per* is indicated one must read *par* and where the sign for *pro* is used *pri* is meant.

In the suspension you get only the first letter or two of the word and supply the rest from your own knowledge. Suspensions are particularly popular for relative pronouns, the commonest verbs, and the like. Thus *q* alone or with a pothook on it may mean *quod;* if *quid* is intended the scribe may write a small *i* above the *q,* but this may also mean *qui.* The very common verb *est* becomes just *e,* sometimes with dots before and after (.e.), sometimes without dots. The most extreme extension of this principle produces "abbreviation by sigils," in which words are represented only by their first letter. This is used for verses of Scripture, well-known laws, and the like, which the reader could presumably supply from memory. If a 14th-century scribe had quoted the beginning of the Declaration of Independence, he would probably have written, "When in t. c. o. h. e, etc." Naturally this practice can be rough on the reader who has failed to memorize the whole Bible and the chief monuments of canon and civil law.

Fortunately, one gets used to the conventional signs and to the commonest suspensions, but new contractions are forever coming up. The contraction simply omits most of the letters of a word, as seen in *Ihs* for *Jesus, Ds* for *Deus,* and *Dns* for *Dominus.* Our *Xmas* has such an ancestry, the *X* being originally the Greek letter χ, chi, and standing for *Christos.* Usually contractions are indicated by a line over the word. There are hundreds, and the reader of manuscripts must keep beside him some such reference work as Martin's

Record Interpreter or Cappelli's dictionary of abbreviations. The latter lists about four thousand contractions, and anyone who works long with manuscripts will be able to add to the list.

Sometimes the same contraction has more than one meaning. In the manuscripts I read, the contraction *splr,* meaning either *specialiter* or *spiritualiter,* appeared often. An unusual difficulty appeared when one of the sermons I was editing contained a long discussion of the theory of lordship, *dominium* in Latin. Like any often-used word this was contracted, *dnm,* which could also be the accusative case of *Dominus.* Only a careful consideration of the context prevented misreadings.

The art of printing has led us to expect that one copy of a book will be pretty much like another. If the two copies are of the same edition, they will usually be identical, the same words in the same positions on every page. Even books with a great many editions, like the Authorized Version of the Bible, will vary little: one can be reasonably certain that the twenty-third Psalm will read the same in his personal Bible, in the big old family Bible, and in the Gideon Bible of the hotel room. A few typographical mistakes perhaps—extremely few in carefully supervised publications like a Bible—and once in a great while a passage changed or suppressed.

It was otherwise when books were handwritten. Every copy of a work was different from every other copy, for each was a product of the human hand; and it would transcend the miraculous if any human being, no matter how well trained or how painstaking, copied, without omitting or adding a single word or changing the order of words or even letters, a hundred, even fifty, pages of a book. Careful medieval scribes worked out all sorts of precautions against mistakes, even setting up tables of the number of letters per chapter of the Hebrew Old Testament, but human proneness to error always defeated the hope of perfection. One scribe made a

letter carelessly; the next to copy his work misread the word; the third tried to change the context to correct the error and made a worse one in the process; and so on.

My job of editing involved nine manuscripts and one printed version. It did not take long to discover that the printed version was worse than useless. Some passages made no sense; others were confused in grammar; and occasionally a real howler appeared. There was, for instance, a reference to *"articulis 4 ad Heb."* Now, there is an Epistle to the Hebrews, but what is an "article to the Hebrews"? and why the ablative plural? The manuscripts made it clear that the reference was to "Ar 4 eth," the fourth book of Aristotle's *Ethics,* presumably the *Nicomachean.* Of course it had been abbreviated in the manuscript and a careless editor or an ignorant printer had muffed the reading. So I must look to the manuscripts for my authorities.

Usually when you have several manuscripts you try to make a tentative judgment on which is best. You then transcribe it in its entirety, compare it with the others, and make necessary corrections in your text. For what is called a critical edition, one based on all known manuscripts, editorial practice requires that you give variant readings, that is, every word or series of words which varies from the one you give in your text. Before getting to the actual business of making the hundreds of decisions that add up to the best text you can produce, you must set up an apparatus, a sort of shorthand to denote the manuscripts you are using. The old way was to name the manuscripts arbitrarily *A, B, C,* and so forth. In very complicated jobs, like scriptural exegesis, these sigils, as the letters denoting manuscripts are called, might include a series of Greek letters. More recently, editors have tried to make their sigils meaningful. A manuscript from the Bodleian Library at Oxford becomes *B,* one from Lambeth Palace in London, *L,* or if one also has a Lansdowne manuscript, *Lb* for Lambeth and *Ld* for Lansdowne. Since I used

three manuscripts from the Bodleian, I had to resort to superscript numerals: B^1, B^2, and B^3.

Having done this, I started the collation, or word-by-word comparison of the nine manuscripts. In transcribing the first manuscript, *Ld,* I quadruple spaced, so as to leave plenty of room for variants. At first I wrote in pencil above the typed text all the variants, identifying them by sigils. But I soon discovered that I could do the work more quickly and accurately if I used a different colored pencil for each manuscript, red for B^1, green for B^2, and so on. With every mechanical aid I could devise, the task was tedious in the extreme, and it required an abundance of faith in the final result to keep at it. The electronic genius who can devise a collating device for manuscripts will earn the gratitude of scholars; but of course it will not be invented, for there is no use for a collation machine in business, and the only people who could use it could not afford it.

The results of the collation were amazing. Variant readings which had to be noticed (I early eliminated differences in spelling and meaningless transpositions of words) averaged thirty to the page, or one to the line. In almost every line of more than a hundred pages of typescript, one or more manuscripts disagree with the others. Many of the variations involved abbreviations. Some manuscripts had *g* with a squiggle, which denoted either *ergo* or *igitur,* both meaning approximately "therefore." Some manuscripts would write this out as *ergo,* others as *igitur.* This variation does not of course affect the meaning.

But others did. In several cases a negative had either been left out or inserted, and it required careful reading of the context to decide which. One or more lines or parts of lines found in some manuscripts were missing in others. Sometimes the reason was obvious. If a word is repeated a little later in the sentence, the eye will often skip the matter between the two occurrences of the word. In the Declaration of Inde-

pendence, for instance, the phrase "the Laws of Nature and of Nature's God" might come out "the Laws of Nature and of God." The chances of such omission are greatly increased if the repeated word occurs in the following line approximately under the first use. Some manuscripts afforded a hundred examples of this sort of lacuna, as the editor calls such an omission. That is, of course, a sure proof of carelessness on the part of the scribe, and a good reason for regarding the manuscript with suspicion.

I had very few examples of a well-known type of addition. One instance occurred when in the middle of a sentence I found in one manuscript the phrase *"non fuit allegatum"* (it was not alleged). The phrase did not fit the context; by no sleight of hand could I make sense of the passage in which it occurred, except by omission. An experienced editor to whom I showed the passage was sure that here was a sample of a marginal note which got into the text. In the manuscript of which mine was a copy, some reader had written *"non fuit allegatum"* on the margin. The scribe then supposed that the phrase was an omission which the corrector had put on the margin for inclusion in the text, and so the scribe included it. Such marginalia, I am told, are frequent in late copies of the classics, and Catholics regard the last phrase of the common Protestant version of the Lord's Prayer, "for thine is the kingdom," as a piece of marginalia that has crept into the text.

One other fairly common phenomenon I encountered. In one of the manuscripts I found a displacement of material. The sermon was organized into twenty-one headings. In a certain manuscript, *P*, the first part of point thirteen appeared in its right place, followed by point fourteen, then the last part of point thirteen. One way that the displacement could have happened is that the pages in the copy from which *P* was made somehow got disarranged, and were rearranged wrongly.

Collation serves several purposes. The most obvious, though not the most important to editors, is that words or passages which are obscure in one manuscript are likely to be clear in another. By the time I had collated the third manuscript, I had filled in all the blanks I had left in my transcription of the first. A more important use is that by comparing the variant readings you can arrive at a pretty accurate notion of which is the best manuscript. For instance, I could eliminate B^3, which abounded in mistakes, *N*, which had many lacunae, and so on. By comparing variant readings I could form some notion of which of two alternatives was the original and which the error, when both versions made sense.

Paleographers and editors have worked out rules for choosing between variant readings. One of these rules, that the harder reading is more likely to be the correct one, though it seems to violate good sense, is actually most useful. It can be illustrated again from the Declaration of Independence. Suppose that one version of it read, "a decent respect *for* the opinions of mankind," whereas another read "a decent respect *to* the opinions of mankind." Which is the correct reading? Well, *for* is certainly commoner in such phrases than *to*. It is quite conceivable that a twentieth-century copyist should substitute *for* for *to;* it is extremely unlikely that anyone would substitute *to* for *for*. Hence, *to* is the harder reading, therefore probably the correct one.

By the consideration of variant readings the editor can construct a "genealogy" for his manuscripts, a hypothetical order in which they came into existence, which would explain which manuscripts came from which. The editor wants as the basis of his text the manuscript nearest the author's original. Early manuscripts, those written near the date of the composition of the work, are of special interest. But it does not necessarily follow that because manuscript *A* was written fifty years before manuscript *B* it is closer to the original. It is possible that *B* is a copy of *X*, which in turn is

a copy of *Q*, the author's original. On the other hand, *A* may be a copy of *C*, which is a copy of *D*, which is a copy of *E*, which is a copy of *Q*. These facts may show up on a comparison of the various manuscripts.

In looking over the various manuscripts I had collected, I could separate them into groups. Thus when B^3 varied from *Ld*, in four cases out of five two other manuscripts, *S* and *J*, varied in exactly the same way. The same was true of B^1 and *N*. *N*, however, was a very sloppy manuscript, with many palpable errors not found in B^1. Here the conclusion was obvious: *N* could be a copy of B^1, but not the other way round. So little by little, I worked out the affinities and affiliations and could risk a hypothesis which accounted for the phenomena I had observed.

The relationships which I could hypothesize came in very handy when I came to the final task, the one for which all the rest was preparation, the "making of the text." This involved deciding which manuscript to adopt as a basic text and what to do about all the variants from that manuscript, whether to substitute them for the readings of my basic manuscript or to keep them in the "corpus of variants." In ninety percent of the cases there was no problem. Either the variant readings made no sense, or they made no significant changes in either grammar or sense. On the remaining ten percent I had to make decisions.

Here is the worst peril of the editor. He naturally wants a smooth and clear text; he will instinctively prefer the reading better in grammar, or more graceful in style, or clearer in sense. But is that what the author intended? Some authors are careless, some work in great haste. And what is a better reading? For some purposes "eighty-seven years" might be a better reading than "four score and seven," but certainly not in the Gettysburg Address. My author, FitzRalph, was wont to stick in saving phrases, which he hoped would clear him of any charges of heresy. Sometimes he had to skate very close to

propositions which had previously been condemned as heretical. Leaving out such saving statements certainly made many sentences clearer and more forceful; but I was pretty certain that FitzRalph wanted them in.

I made plenty of mistakes, which a patient editor later pointed out to me. There were revisions and re-revisions, until at last the text was the best I could make it. This was of course only a beginning at the mass of documents I had discovered and had microfilmed. Still to come were the defenses by the friars. But the experience had taught me much about the nature of books, and since books are the carriers of thought, much about the nature of thought in the middle ages.

This whole project, you will remember, started with a student's question about the friar's cope. Long ago I discovered that the enemies of the friars had a standard jibe, which ran, "Why should I give alms to a friar whose cope is worth more than all my clothes together?" Recently I published a short article, showing how familiar this jibe was to Chaucer's readers. By the time the article came out, information about the friar's cope was only a by-product of a large study. This sort of development is fairly typical of humanistic scholarship. It usually grows out of teaching. Either students ask questions, or the personal curiosity of the teacher is stimulated by something he reads in the course of preparing teaching materials. Often the search ends far from where it started; sometimes it never ends. I suspect that this is the common condition of the pursuit of truth in all its forms. You pursue truth whither it leads, and you find truth where it lies.